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BIBLIOGRAPHY OF THERMAL EXPANSION OF GLASSES

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Introduction

The influence of temperature on the physical and chemical behavior of matter constitutes a field of study of great practical importance and theoretical interest. Of the different physical properties, the effect of temperature on the dimensional changes of matter has received special attention. In spite of this favored position, very little is known about the cause and extent of the dimensional changes. For a large majority of substances the dimensional changes are positive; that is, the dimension increases with increasing temperature. However, there are a large number of substances for which the dimensional changes are negative, at least over certain ranges of temperature. When the dimensional changes are positive, as they commonly are, the property is referred to as thermal expansion. The rate of thermal expansion or the expansivity of a substance is most commonly measured by the coefficient of linear expansion (α) defined as the change in length per unit length per unit rise in temperature. Mathematically

$$\alpha = \frac{\Delta l}{l} \cdot \frac{1}{\Delta T}$$

For isotropic substances, the coefficient of volume expansion (β) is three times the coefficient of linear expansion (α). No such simple relationship exists for anistropic substances.

In the field of glass technology, the property of thermal expansion plays a leading role as it is extremely influential in limiting the usefulness of a glass composition. Most present day industrial uses of glass were made possible by the development of glasses having the desired expansion characteristics. A knowledge of the expansion behavior of glass is imperative in the successful joining of glass to glass, glass to ceramics, or glass to metal. The whole field of radio, television and electronics hinges to a large extent on successful seals of the type mentioned above. The use of glass in structural products and in industrial pipe-lines and heat-exchangers is made possible by the low expansion coefficients of these glasses. The importance of an accurate knowledge of the volume coefficient of glass for finely calibrated instruments, such as thermometers and burettes, is obvious.

In view of its immense practical importance this property of glass has received considerable attention from both the theoretical and practical standpoints. However, it must be stated that not too much headway has been made in understanding thermal expansion from a theoretical viewpoint. The practical glass technologist is interested primarily in developing new compositions to meet new applications. Consequently, his main objective is to have a knowledge of the contribution of the different oxides used by him to the thermal expansion coefficient of the final product. In keeping with this objective and assuming the property to be additive, the early workers were able to formulate factors for the contribution of the various constituent oxides. The calculated values of the coefficient were in fair agreement with the observed values, if the factors were used in the composition range for which they were derived originally. The lack of agreement between the observed and calculated values of the coefficient for a glass in a different composition range led various investigators to propose different values for the factors of the same oxide; these have been listed by Sun and Silverman.* In spite of the lack of uniformity, these factors have proved quite useful.

The scientist is primarily concerned with studying the effects of the various oxides and of the systematic substitution of one oxide by another on the expansion behavior of simple glasses and, on the basis of such information, developing a theory for the expansion behavior of glasses and the constitution of glass itself. The development of crystal chemistry in the past twenty-five years has opened a new approach to the problem of the structure of glass and it is only in comparatively recent years that the replacement of one oxide by another has been guided by considerations of ionic radius, charge and polarizability.

Thus from whatever angle one approaches the problem of the thermal expansion of glass, theoretical or prac-

* K. H. Sun and A. Silverman, Glass Ind., *22* (3) 114-115, 125 (1941).

tical, a complete knowledge of the expansion coefficient of simple glasses of known composition is essential. Such information is available to a certain extent in the "Glastechnische Tabellen" of W. Eitel, M. Pirani and K. Scheel and in the more recent classic of G. W. Morey, "The Properties of Glass." However, almost fifteen years have elapsed since the publication of the last-mentioned volume and new information has accumulated in that period. In this bibliography, an attempt is made therefore to provide as complete a summary as possible of the coefficients of expansion over a limited range of temperature for simple glasses of one, two, three, four and five oxide constituents. The glasses are divided into systems of increasing complexity. Within each system the compositions are arranged systematically following the vertical groups of the Periodic Table.** In so doing the "A" subgroup elements are given precedence over the "B" subgroup elements. Thus, for example, sodium precedes potassium, barium precedes zinc and borates precede silicates.

The various methods used to determine the thermal expansion of glass, may be divided into two broad groups: (a) for measuring the volume expansion and (b) for measuring the linear expansion. Each of these methods has its respective merits and demerits. Some are more accurate than others. In general, however, the results obtained by most methods are accurate within ±2 per cent. In preparing this bibliography no attempt has been made to evaluate the results, which are merely reported from the original publication, except as indicated in a few cases.

The weight per cent composition of glasses determined by chemical analysis is marked by an asterisk; those not so marked represent the weight per cent composition of the oxides in the batch. If all the compositions investigated by a particular author have been chemically analyzed, the asterisk is placed near the first composition only and all the following compositions credited to that author also represent the weight per cent composition by chemical analysis of the glasses.

In certain cases the information given in the publication was not adequate and all the authors concerned except one have given complete cooperation in supplying the additional information. The author wishes to take this opportunity to thank those persons for their kind cooperation.

** A copy of the Periodic Table can be found in any textbook of general chemistry or in handbooks like Perry's or the Rubber Handbook.

UNARY SYSTEMS

System No.	*System*	*Investigator*	*Weight Per Cent Composition*	*Coefficient of Expansion ($\alpha \times 10^7$)*	*Temperature Range (°C.)*
1	B_2O_3	A. Cousen and W.E.S. Turner J. Soc. Glass Tech., *12*,169T (1928)	B_2O_3 100	151.0	
		E. J. Gooding & W.E.S. Turner J. Soc. Glass Tech., *18*,32T (1934)	100	152.7	0-100
		L. Grenet, Compt. Rend., *123*,891 (1896)	100	141.4	0-100
		L. Grenet, Bull. soc. encour. ind. nat., *96*,772 (1897)	100	144.6	0-100
		M. O. Samsoen, Compt. Rend., *181*,354 (1925)	100	143.0	at 0
		idem, ibid, *183*,517 (1926)	100	151.8	at 100
		M. O. Samsoen, Bull. Soc. d'Encourage, *185* Mar. 1929	100	143.0 145.0	at 0 at 100
		E. Seddon & W. E. S. Turner J. Soc. Glass Tech., *17*,324T (1933)	100	154.1	0-100
		M. E. Spaght & G. S. Parks J. Phys. Chem. *38*,103 (1934)	100 (unannealed)	133.1 63.3 —63.3 —356.3 183.3 1,366.6 2,073.3	at 122.1 152.3 180.4 204.9 229.4 250.2 270.0
			100 (carefully annealed)	160.0 122.5 147.5 393.3 1,350.0 2,043.3 1,973.3	at 114.2 143.4 171.8 199.6 226.9 250.0 270.0
		R. Wenig & E. Zschimmer Sprechsaal, *62*,855, 874,889 (1929)	100	152.2	0-100
2	SiO_2	S. J. Barnett, Phys. Rev. *6*,114 (1898)	SiO_2 100	3	Rm.t-100
		H. I. Callender, Chem. News, *83*,151 (1901)		5.8	300-900
		F. Henning, Ann. Phys., *22*,631 (1907)		3.1	Rm.t-190
		L. Holborn & F. Henning Ann. Phys., *10*,446 (1903)		5.4	16-1000

System No.	System	Investigator	Weight Per Cent Composition			Coefficient of Expansion ($\alpha \times 10^7$)	Temperature Range (°C.)
		H. leChatelier, Compt. Rend., *130*,1703 (1900)			SiO_2	7	0-1000
		R. B. Sosman, "The Properties of Silica," Chemical Catalog Co., New York 1927, p. 363			100	—3.5	at —250
						—2.0	—200
						—0.33	—150
						+1.03	—100
						+2.5	—50
						+3.8	0
						+4.3	50
						+4.8	100
						5.2	150
						5.3	200
						5.6	300
						5.7	400
						5.7	500
						5.6	600
						5.4	800
						5.4	1000
		W. Souder & P. Hindert Bur. Std. Sci. Paper No. 524 (1926)			100	4	20-60
						5	20-200
						5.5	20-400
						5.3	20-600
						5.0	20-750
						4.8	20-1000
		J. B. Saunders, J. Res. Nat. Bur. Standard, *28*,51 (1942)			100	5	20-200
3	GeO_2	L. M. Dennis & A. W. Laubengayer, J. Phys. Chem., *30*,1510 (1926)			GeO_2 100	73.0	22-348
						91.3‡ (‡2nd heating)	20-414
		BINARY SYSTEMS					
4	Li_2O-B_2O_3	L. Grenet, Compt. Rend., *123*,891 (1896)			Li_2O	B_2O_3	
					4.1	95.6	90.0
					7.9	92.1	64.6
					9.7	90.3	59.0
					12.5	87.5	67.8
		L. Grenet, Bull. Soc. encour. ind. nat., *96*,772 (1897)			4.1	95.9	93.4
					7.9	92.1	67.8
					9.7	90.3	62.2
					12.5	87.5	71.0
5	Na_2O-B_2O_3	E.J. Gooding & W.E.S. Turner* J. Soc. Glass Tech., *18*, 32T (1934)			Na_2O	B_2O_3	
					2.34	97.66	141.2
					3.44	96.56	138.6
					5	95	127
					7.82	92.18	110.2
					10	90	100
					11.44	88.56	93.2
					15.78	84.22	84.9
					18.53	81.47	89.5
					20	80	90
					21.81	78.19	91.3
					25	75	96
					30.12	69.88	102.5
		L. Grenet, Compt. Rend., *123*,891 (1896)	$1Na_2O \cdot 16 \cdot 83B_2O_3$		5.0	95.0	101.9
			$1Na_2O \cdot 10 \cdot 18B_2O_3$		8.1	91.9	93.3
			$1Na_2O \cdot 5 \cdot 13B_2O_3$		14.8	85.2	81.7
			$1Na_2O \cdot 2 \cdot 5B_2O_3$		26.3	73.7	70.4
			$1Na_2O \cdot 2B_2O_3$		30.8	69.2	95.3
		L. Grenet as corrected by L. Navias, J. Amer. Cer. Soc. *18*,206 (1935)	$1Na_2O \cdot 16 \cdot 83B_2O_3$		5.0	95.0	105.0
			$1Na_2O \cdot 10 \cdot 18B_2O_3$		8.0	92.0	96.7
			$1Na_2O \cdot 5 \cdot 13B_2O_3$		14.7	85.3	87.6
			$1Na_2O \cdot 2 \cdot 5B_2O_3$		28.6	71.4	94.2
			$1Na_2O \cdot 2B_2O_3$		30.7	69.3	111.9
		M. O. Samsoen, Ann. Physique, *9*,35 (1928)			0.8	99.2	132.0
					1.4	98.6	129.0
					5.0	95.0	103.0
					6.7	93.3	98.5
					8.0	92.0	95.0
					15.0	85.0	86.4
					22.1	77.9	93.0
					30.7	69.3	111.0
					33.4	66.6	106.0
					42.8	57.2	80.5
5a	K_2O-B_2O_3	R. L. Green J. Amer. Ceram. Soc., *25*,83 (1942)			K_2O	B_2O_3	
						100	159.3
					*10.38	89.62	135.0
					15	85	121.4
					*21.02	78.98	117.7

System No.	System	Investigator	Weight Per Cent Composition			Coefficient of Expansion ($\alpha \times 10^7$)	Temperature Range (°C.)
5a (Continued)			K_2O	B_2O_3			
			25	75		117.5	
			*30.49	69.51		124.9	
			40.40	59.60		160.3	
6	SiO_2-B_2O_3	A. Cousen & W. E. S. Turner* J. Soc. Glass Tech., *12*,169T (1928)	SiO_2	B_2O_3			
			0	100		157.0	0-100
			5.23	94.77		131.7	
			9.99	90.01		118.1	
			14.81	85.19		111.4	
			24.45	75.55		87.0	
			38.03	61.97		71.9	
			45.51	54.49		57.6	
			52.17	47.83		49.8	
			57.24	42.76		47.5	
		M. O. Samsoen Ann. Physique *9*,35 (1928)	5	95		133.0	
			10	90		130.7	
			17	83		108.0	
			23	77		84.6	
			28.5	71.5		77.0	
			33.35	66.65		61.5	
		E. J. Gooding & W. E. S. Turner J. Soc. Glass Tech., *18*,32T (1934)	5	95		134.0	0-100
			10	90		118.0	
			15	85		110.0	
			20	80		100.0	
			25	75		89	
			30	70		80	
			35	65		73	
			40	60		67	
			45	55		60	
			50	50		54	
			55	45		48	
			60	40		43	
			65	35		38	
			70	30		33	
			75	25		29	
			80	20		24	
			85	15		19	
			90	10		15	
			95	5		10	
7	PbO-B_2O_3	M. O. Samsoen Ann. Physique *9*,35 (1928)	PbO	B_2O_3			
			51.4	48.6	$3B_2O_3$·PbO	69.5	0-100
			55.4	44.6	$2{\cdot}5B_2O_3$·PbO	63.0	
			61.4	38.6	$2B_2O_3$·PbO	69.5	
			76.1	23.9	B_2O_3·PbO	99.0	
			82.7	17.3	B_2O_3·1·5PbO	111.0	
			86.4	13.6	B_2O_3·2·0PbO	124.0	
			91.6	9.4	B_2O_3·3·0PbO	129.5	
8	Li_2O-SiO_2	A. E. Dale, E. F. Pegg & J. E. Stanworth, J. Soc. Glass Tech., *35*,136T (1951)	Li_2O	SiO_2			
			20.0	80.0		115.0	0-300
		A. Dietzel & H. A. Sheybany Verre et Refract., *2*,63 (1948)	8.69	91.31		53.6	Rm.t.
			15.10	84.9		82.2	to
			19.04	80.96		110.0	transf. pt.
9	Na_2O-SiO_2	A. Dietzel & H. A. Sheybany Verre et Refract., *2*,63 (1948)	Na_2O	SiO_2			Rm.t.
			20.46	79.54		99.6	to
			26.18	73.82		115	transf. pt.
			31.20	68.80		141	
		S. English & W. E. S. Turner J. Soc. Glass Tech., *5*,121T (1921)	*17.17	82.83		75.5	0-100
			18.66	81.34		84.9	
			20.87	79.13		91.7	
			23.73	76.27		103.5	
			25.95	74.05		113.8	
			29.62	70.38		124.0	
			33.09	66.91		134.6	
		E. J. Gooding & W. E. S. Turner J. Soc. Glass Tech., *18*,32T (1934)	5	95		27.5	0-100
			10	90		50	
			15	85		77	
			20	80		91	
			25	75		106	
			30	70		123	
			35	65		140	
			40	60		157.5	
			45	55		170	
			50	50		177	
		E. Rencker, Compt. Rend., *197*,840 (1933) J. Soc. Glass Tech., *18*,112A (1934)	20.0	80.0		100	20-400
			25.0	75.0		115	
			27.5	72.5		126	
			30.0	70.0		136	
			37.0	63.0		170	

System No.	System	Investigator	Weight Per Cent Composition		Coefficient of Expansion ($\alpha \times 10^7$)	Temperature Range (°C.)
			Na_2O	SiO_2		
		E. Rencker, Compt. Rend., *199*,1114 (1934)	21	79	91	20-400
			24	76	105	
			27	73	114	
			30	70	124	
			38	62	155	
		M. O. Samsoen, Compt. Rend., *183*,285 (1926)	8.0	92.0	70.7	at 15
			14.5	85.5	90.5	
			21.75	78.25	100.2	
			24.0	76.0	110.6	
			30.0	70.0	128.5	
			33.8	66.2	134.5	
			37.0	63.0	138.0	
			40.0	60.0	155.0	
			43.0	57.0	185.2	
			45.0	55.0	187.8	
			47.0	53.0	155.5	
			50.8	49.2	126.1	
		M. O. Samsoen Ann. Physique, *9*,35 (1928)	20.2	79.8	108.1	0-100
			30.0	70.0	132	
			51.0	49.0	129	
		B. C. Schmid, A. N. Finn & J. C. Young, J. Res. Nat. Bur. Standards, *12*,421 (1934) RP667	*17.24	82.76	90.7	25-400
			17.28	82.72	90.7	
			19.96	80.04	101.5	
			20.27	79.73	101.5	
			21.39	78.61	106.7	
			21.15	77.85	109.5	
			23.35	76.65	117.5	
			23.40	76.60	117.5	
			27.85	72.15	136	
			29.56	70.44	147	
			29.79	70.21	147	
			30.35	69.65	147	
			32.86	67.14	155	
			34.70	65.30	163	
			37.14	62.86	176	
			40.03	59.97	187	
			42.55	57.45	195	
			45.86	54.14	203	
			47.85	52.15	216	
		E. Seddon & W. E. S. Turner J. Soc. Glass Tech., *17*,324T (1933)	*19.23	80.77	95.2**	0-100
			25.35	74.65	111.3	
			39.29	60.71	161.0	
					(**heated at 1°C. min.)	
		W. E. S. Turner & F. Winks J. Soc. Glass Tech., *14*,109T (1930)	*8.40	91.60	43.0	0-130
			11.83	88.17	57.0	
			14.96	85.04	73.1	
			17.66	82.34	83.3	
			20.07	79.93	90.7	
			22.70	77.30	101.5	
			25.35	74.65	106.0	
			26.41	73.59	109.4	
			27.20	72.80	114.6	
			29.73	70.27	122.7	
			32.89	67.11	134.5	
			36.52	63.48	141.9	
			39.72	60.28	155.0	
			44.88	55.12	165.7	
			48.85	51.15	176.5	
10	K_2O-SiO_2	A. Dietzel & H. A. Sheybany Verre et Refract., *2*,63 (1948)	29.21	70.79	114	Rm. t. to
			32.11	67.89	130	tr. pt.
			36.11	63.89	140.6	
10a	PbO-SiO_2	G. J. Bair J. Amer. Ceram. Soc., *19*,347 (1936)	*PbO	SiO_2		
			62.6	37.0	65.1	250-350
			71.1	28.6	77.4	
			79.4	20.3	91.6	
			84.6	15.0	112.0	

(*To Be Continued*)

F. W. FRALEY APPOINTED TO NEW NPA POST

The appointment of Fred W. Fraley as Assistant Administrator in charge of the Chemical, Rubber and Forest Products Bureau has been announced by Henry H. Fowler, Administrator of the National Production Authority.

Mr. Fraley, a Vice President of the Diamond Alkali Company, joined the NPA in March 1952 as an Assistant Director of the Chemical Division. During World War II, he was a member of WPB and Munitions Board industry advisory committees. Before joining NPA, he was a member of the NPA Alkali-Chlorine Industry Advisory Committee.

PROBLEMS IN MAKING JOB SETUPS

By R. C. LAWSON

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This paper is part of a symposium on job training in the glass industry. The text is limited to job training in the container industry, although some portion of it may be generalized to include other branches of glass manufacture.

The most complicated combination of operations and adjustments in manufacture of glass containers occurs in the process of changing from one job to another. The skill and efficiency applied to a job change are major factors in plant production.

There are six units of the manufacturing line which may require changes in equipment or adjustment when a job change is made. The forehearth may require change in firing or cooling; the feeder: change of orifice ring, speed, gob-shaping cams or adjustment; the forming machine: change in delivery equipment, molds, mold holders, and machine settings; the conveyor: change of height and spacing of ware; the stacker: change of tong arms, cams, and ware spotter; the lehr: change of belt speed, temperature, and damper settings.

It may be recognized that, while the greatest concentration of changes and adjustments occur within the bounds of the forming department, coordination with other departments of the plant is required. If the new job requires more, or less, glass, changes in operation of the furnace and of batch chargers must be made. At the other end of the production line, carton assembly, inspection and warehousing or shipping will be involved.

From the foregoing outline of operating requirements, it is evident that a job change demands, not only great mechanical skill on the part of operators and foremen, but also considerable planning and judgment on the part of management. In many respects a job change resembles a complicated play in football. Relative success of the job-change play is measured as the time to restore normal production. The shorter the time, the better is the execution of the play.

Efficiency in making job setups depends in large measure on the training of the people comprising the job-change team, and in the coordination of their operations. Some idea of the complexity of the "play" can be gotten from the fact that there are as many as 70 changes and adjustments to be considered. Some of these are very simple to make, while others require a maximum of skill. Usually there is no problem in obtaining good workmen, but there is often considerable trouble in getting their duties organized and planned.

Adequate records are the key to efficient operation. The job setup record is of greatest importance. This record should show all assignments of individuals, and details of settings and temperatures. If procedures or settings are changed, these changes must be recorded and kept up to date. It is only by keeping the setup record in detail that good production runs can be repeated and operating efficiency improved.

In many factories the men comprising the job-change team have had many years of experience and have literally grown up with the machines they operate. As these men grow old and approach retirement, management is faced with the problem of training younger men to carry on in their places. When it is considered that twenty, thirty or even fifty years have gone into the training of some of the older men, it is suddenly realized that specialized training represents a very large investment in both time and money, so large in fact that it may not be possible to repeat the same training procedure for a new generation of foremen and specialists.

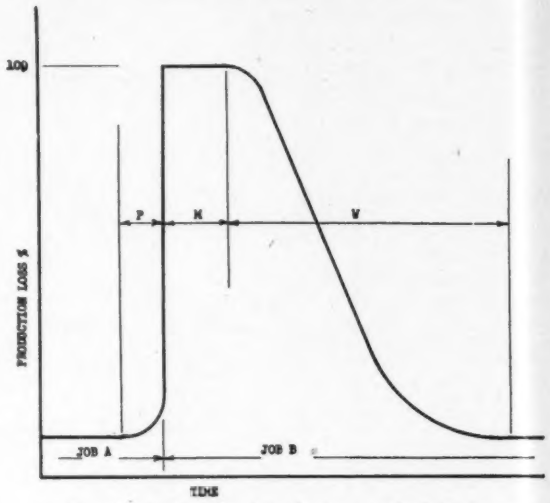


Fig. 1. Production loss during a job change.

It is not the purpose of this paper to outline training programs, but rather to point out the necessity of having a definite plan for training. It will not be sufficient to depend on individual skills. By some means there must be developed a team skill. If the cost of training is to be kept to a reasonable figure it may be necessary to put training on a more formal basis than it has been in the past. Many companies have hired specialists to organize their training programs. It is likely that some such step will have to be taken by nearly all glass manufacturers before long. Where it is not feasible to hire a full-time director of training, use can be made of part-time services of qualified persons.

Problems in making job setups originate from the complexity of the operation involved, rather than from the difficulty of making individual adjustments. Solution of these problems depends upon coordination of the skills available, which in turn depends upon a training program, carefully planned and properly executed.

The effect of a job change on production is illustrated in Figure I. In changing from job "A" to job "B" there are three periods of loss, designated by "P," "M" and "W."

While job "A" is still on the machine there will be some drop off in production in preparation, "P," for start of job "B." Adjustment of forehearth firing, and decrease in routine swabbing and inspection may account for this

(*Continued on page* 432)

Presented before the Twelfth Conference on Glass Problems, University of Illinois, Urbana, Illinois.

THREE RECENT REPORTS FROM THE NATIONAL BUREAU OF STANDARDS

ELECTRON-OPTICAL BENCH

A versatile electron-optical bench has recently been constructed at the National Bureau of Standards for the extensive study of electron-optical elements. Carriages for magnetic lenses, mirrors, or prisms and holders for apertures, objectives, and meshes are arranged appropriately in a vacuum chamber. External positioning controls are also provided, offering three degrees of freedom for each element. The bench was developed by the NBS electron physics laboratory under the direction of Dr. L. Marton. It has become an integral part of a program devoted to the investigation of extremely small electric and magnetic fields in spaces that have heretofore been inaccessible to conventional types of measurement.[1]

Electron-optical methods have been successfully applied to the measurement of magnetic fields around magnetized recording wires,[2] the fringe fields issuing from ferro-magnetic domains, and the space-charge distribution of a d-c cut-off magnetron.[3] Besides being able to measure these fields, the NBS electron-optical bench can be adopted for electron-optical field mapping, as an electron microscope, electron diffraction camera, or any instrument having closely related characteristics.

For simplicity of construction and protection against X-rays, the bench is made with an all-metal cylindrical vacuum chamber. It is designed to satisfy the following requirements: (1) To accommodate three carriages for lenses with maximum diameters of 7 in. and four holders for apertures, test objects, and meshes (for use in field mapping). (2) To permit a movement of 10 in. along the axis of the bench and one-half inch radially for each component of the system without breaking the vacuum.

One end plate of the electron-optical bench supports the electron gun and is permanently fixed to the cylinder with bolts and a rubber gasket vacuum seal. A heavy dural plate serves as the bed for the electron-optical system and is provided with wheels so that the whole system may be rolled in or out of the chamber. The face plate is sealed against the end of the cylinder by a neoprene gasket compressed by atmospheric pressure. A fluorescent screen (5-7/8 in. in diameter and 7/8 in. thick) and "Wilson seals"—through which pass the connecting shafts that control the motion of the elements—are inserted into the face plate.

Radial adjustment of each element is obtained by properly combining controlled vertical and horizontal motions of the lens carriage and holders, achieved by worm and gear arrangements. The axial position of the carriage is controlled by pushing or pulling the connecting shafts through the Wilson seals. Radial motion is constrained by elastic deformation of phosphor bronze strips instead of sliding surfaces.

Current leads for the electron lenses enter the vacuum chamber through metal-glass seals in the face plate. The conductors are insulated by ceramic beads, which produce less outgassing difficulties than would result if rubber or plastic insulation were used. The lenses available for use in the bench were originally designed for use with the coils out in the atmosphere rather than in a vacuum chamber. Because the coils release large quantities of gas to the vacuum system, a rapid pumping system is needed to maintain a working vacuum under these unfavorable conditions. A large fore-pump brings the pressure in the chamber down to about 10 microns of mercury in about 5 minutes. A 4-in. oil diffusion pump is used to maintain an operating pressure of about 3×10^{-2} micron of mercury, measured by an ion gauge installed near the electron gun.

A conventional 100-kilovolt X-ray power supply, consisting of a voltage doubler circuit and two 50-kilovolt rectifier tubes, is used as the high-voltage supply; the normal operating range is between 20 and 70 kilovolts. The filaments are heated by a high-frequency power supply. Lens currents are supplied from seperate power supplies that yield currents up to 500 milliamperes and have a stability of better than 1 part in 10,000. The grid bias for the 100-kv electron gun is obtained from a potentiometer connected across three 45-volt batteries in series.

A large proportion of the measurements made with an electron-optical bench are empirical evaluations of electron-optical systems. In such work the results of one measurement often determine the conditions for the next. Hence, a direct method of measuring the image is preferred because it is faster, less involved, and less expensive than the photographic method of recording results. A specially built low-power traveling telescope, reading to 0.0001-in. and with total travel of 2¾ in., is used to measure the image on the fluorescent screen. Because the NBS bench is designed for use with magnetic lenses, which cause rotation of the image, the measuring telescope is mounted on a turntable. It can be moved a distance of 3 in. either horizontally or vertically so as to keep its center of rotation concentric with that of the image. Thus, all measurements are radial. Variable-intensity side illumination of the reticule reduces the difficulty in seeing the cross hair when the intensity of the pattern on the screen is low.

One of the initial measurements made with the NBS electron-optical bench was that of the focal length of a magnetic lens. The lens was of the condenser type, and the system also included a mesh object and a 10,000-turn objective lens. Diffuse illumination of the object, obtained by applying a thin formvar film and a thin conducting aluminum coating on the source side of the mesh, was used to make the focusing critical. The image distance was held constant throughout the measurements. For a particular accelerating voltage, the object position was adjusted to give approximate focus for different objective currents, the final focus being made by a small adjustment of the current. The focal length was computed from the equation $f = \frac{q}{(M+1)}$, where q is the image distance and M is the magnification.

A graph of focal length vs. objective lens currents for different accelerating voltages shows that the maximum error in determining the focal length was about $\pm$ 0.01 cm. The major limitation on accuracy seems to be the difficulty in setting the cross hair on a point of the mesh image. Improvement of the cross-hair design and development of greater skill in setting may reduce the error

due to this source to less than 1 per cent. The precision with which the image can be focused imposes another limitation. The objective lens and pole piece used in the initial measurement permits the image to be apparently in perfect focus over a current range of about 6 ma. The center of this range can be located within about ± 2 ma. It is believed that this cannot be much improved without elaborate additions to the equipment. Errors due to small inaccuracies in alignment and to hysteresis are believed to be negligible compared to the two limiting factors.

ANNEALING TEMPERATURE OF OPTICAL GLASS

Recent experimental investigations at the National Bureau of Standards have shown that annealing temperatures of optical glass can vary over a wide range without decreasing the very high refractive homogeneity obtainable in the product. These results, obtained in the course of a study[4] conducted by L. W. Tilton, F. W. Rosberry and Florence Badger of the NBS staff should encourage manufacturers of optical glass to use much greater freedom in adjusting the refractive index of their product, with a consequent saving in time and materials.

As glass passes from the liquid to the vitreous solid state, strains are set up within the body of the material. These strains, which seriously affect its mechanical as well as optical properties, are removed by annealing; that is, by heating to a temperature short of the softening point, holding at a somewhat lower temperature long enough to remove the strains, and then cooling gradually. When properly annealed, an optical element is free from strain and is of uniform refractive index throughout.

The annealing of optical glass is one of the most important and most critical processes in its production. As the index of refraction of the glass is affected by both composition and annealing temperature, an exact knowledge of the relationship between these variables is necessary. In general, the glass becomes more dense, and thus of higher refractive index, as the annealing temperature is lowered. Many workers in the field have felt that optical glass cannot be satisfactorily annealed, nor have uniform refractivity, unless it is made as dense and as high in refractive index as possible by "full" or "limit" annealing at the lowest feasible holding temperature. Such a procedure, however, is time-consuming and makes it much more difficult to obtain the desired refractive index within the close limits necessary for some uses of optical glass because with the annealing temperature predetermined, the refractive index becomes almost entirely dependent on composition. As a result, more care and effort in determining the composition of the glass are necessary, and in many cases a batch of optical glass must be discarded because it is not of the desired refractive index. In connection with its program of research on new glass compositions and methods of making optical glass, the Bureau therefore made an experimental study to determine the effect of annealing temperature on refractive homogeneity and strain in the glass.

Ten 2-inch cubes of a borosilicate optical glass were prepared and polished for inspection as to striae and initial strain. After refractive-index measurements with a precision refractometer and preheating at 555°C. for two hours, they were all annealed at the same time in one furnace. The treatment consisted in holding at 515°C. for 12 hours and cooling about as rapidly as advisable after an initial cooling of about 1 degree per hour. This annealing treatment is of intermediate character and corresponds more or less to good annealing practice.

After repolishing and tests of strain and homogeneity, half of the cubes were preheated at 555°C. for 12 hours to insure complete cancellation of all effects of the initial annealing. These cubes were reannealed by holding at 530°C. for 17 hours and cooling from 530°C. to 500°C. at 0.75 degree per hour, then from 500° to 475°C. at 1 degree per hour, etc. The other half of the cubes were reannealed by holding at 490°C. for 15 days (after preheating at 545°C. for 10 hours) and cooling slowly from 490° to 425°C. at 0.5 degree per hour, then from 425° to 400°C. at 0.75 degree per hour, etc.

The first reannealing, at 530°C., with its relatively slow cooling, was designed to produce optical glass about as far below maximum density as would ordinarily occur in practice. The reannealing at the relatively low temperature of 490°C., on the other hand, could be expected to produce glass of higher density and refractivity than is ordinarily obtained. If annealing at a very low temperature is of any advantage in the manufacture of optical glass, the samples reannealed at 490°C. should have shown greater refractive uniformity and less strain than the other samples. However, precise interferometric measurements showed that all three of the annealings produced glass uniform in refractive index within approximately $\pm 10 \times 10^{-7}$. Such glass can be considered practically perfect as far as the users of optical glass are concerned. Likewise, polarimetric measurements showed no appreciable difference in strain as a result of the three different annealing treatments. From these experiments, it was concluded that optical glass of high quality for precision optical instruments can be obtained from annealings in which the holding temperature is 30 or 40 degrees Centigrade above the lowest feasible annealing temperature.

CRYSTAL-GROWING TECHNIQUE

An improved technique for growing small crystals of high-melting compounds is being used at the National Bureau of Standards. In the new method, a hot-thermocouple apparatus simultaneously heats the specimen and measures its temperature, while the operator watches crystal growth through a stereoscopic microscope and manually controls the rate of cooling. The new method was devised by Fred Ordway, of the Portland Cement Association Fellowship at the National Bureau of Standards, to meet needs arising in an X-ray diffraction study of portland cement clinker. However, it should also be applicable to crystallographic studies in other fields.

An X-ray diffraction study requires a suitable single-crystal specimen. The ideal specimen should be pure, free from flaws or twinning, and sufficiently well developed that the crystallographic axes can be found from the orientation of the edges and faces. Because large size is not necessary—crystals only 0.05 to 0.1 mm in least dimension can be used with ordinary X-ray cameras—usable crystals of many substances can be found in natural minerals or in products of manufacture. Occasionally, however, all available specimens of a mineral are either too impure or too finely crystallized, and synthetic melts of the proper composition likewise form crystals that are

too small. This is true of the calcium silicates and aluminates of portland cement clinker being studied in the NBS laboratory, and it is this problem that the new technique was devised to solve.

Earlier work had indicated that single crystals are grown most satisfactorily by manually controlling the cooling of the smallest droplet that will yield a crystal large enough to be used. With a droplet of small size, the possibility of growth of unwanted crystals is minimized. Furthermore, the droplet can be observed through a stereoscopic microscope during the entire crystallization process, which may take several hours. Twins or other extraneous crystals can thus be detected and melted away as soon as they form.

The NBS technique facilitates precise control of the cooling process. A thermocouple of platinum and platinum-10% rhodium is mounted under a stereoscopic microscope. The thermocouple is heated with 5-kilocycle alternating current, supplied through a blocking capacitor. The capacitor prevents the a-c power supply from shorting the direct-current output of the thermocouple, which is measured on an external microammeter that can be calibrated in degrees Centigrade. A small amount of the material under study is placed on the thermocouple, melted, and carefully cooled while crystal formation is watched through the microscope. Although precise control of the cooling process does not require knowledge of exact temperatures, calibration of the NBS apparatus for melting-point determinations indicates a maximum measurement error of only 5 degrees C. in the range 770° to 1420°C.

REFERENCES

[1] For additional technical details, see Electron-optical bench, L. Marton et al, NBS J. Research *47*, No. 6, 461 (RP 2273).
[2] Electron-optical shadow method, NBS Tech. News Bull., *33*, No. 9, 106 (Sept. 1949).
[3] Electron-optical mapping of the space-charge field in a magnetron, NBS Tech. News Bull. *34*, No. 5, 57 (May 1950).
[4] For further details, see Refractive uniformity of a borosilicate glass after different annealing treatments, by Leroy W. Tilton, Fred W. Rosberry, and Florence T. Badger, J. Research NBS *49*, (1952) RP 2341.

COMMENT ON PREVENTIVE SCALE MAINTENANCE

John D. Beeson, of The Exact Weight Scale Company, has written a brief article on preventive maintenance applied to scale. Preventive maintenance strives to eliminate breakdowns before they occur.

The article goes on to say that this aspect of prevention in the field of equipment maintenance has been accented more and more in recent times over the old ideas of merely the repair and replacement of worn out parts. The reason for this shift of emphasis is due to a great many things, such as the scarcity of replacement equipment, the increased cost of this new equipment, and the cost of breakdowns resulting from loss of present high production rates.

The procedure for preventive maintenance, the article continues, is one of periodically providing care and attention to a machine to keep it functioning, to replace worn parts before failure and while not in use, and to prolong the life of the machine. Preventive maintenance actually begins at the time of initial installation. It is concerned with providing a proper support, proper assembly technique, and the alignment and adjustment of parts so that the equipment will be functioning within the capacities and conditions for which it was designed.

Scales, like all other mechanical devices, also require maintenance. Here again the amount of maintenance depends upon the complexity and the accuracy required. Actually, the scale is a border-line case between an instrument and a production tool. It is used in industry not only to determine monetary values of products, but also as a fast, accurate means of quality control in the mixing and processing of a product. This latter usage in many cases is of as great importance to the producer as the actual portioning out for sale.

Even though scales do play such a vital role, most users, while they may be conscious of maintaining their other equipment, seem to overlook the importance of proper maintenance for their weighing devices. Yet in most cases all that is needed in the way of preventive maintenance is that it be kept clean and free.

Once a scale unit is installed correctly, with rigid supports and so placed that it receives the commodity without excessive abuse, it will operate properly for many months with only frequent dusting and inspection of the dashpot, if one is used. As for overhauling or replacement of parts on a scale, this work should be done by personnel familiar with weighing devices and who have had instruction in the art.

Companies who use a great many scales have found it advantageous to set up a scale department that has complete charge of the installation and maintenance of all of their weighing equipment. Some companies have found it useful to retain records of each scale, with information as to purchase date, specifications, the date of the last overhaul and the parts that were replaced. From these records it can be determined approximately when it should be returned to the scale shop for checking.

Other companies, who perhaps may have only a few scales in use, rely upon responsible scale repairmen who provide scale service as their business or as a part of their business. These companies have found that having their scales serviced by these men, usually under some sort of a contract, has proven to be a great asset against downtime due to scale failures. In any case, it will be found that the practice of preventive maintenance and repair will prove beneficial in dollars and cents when it is applied to scales as it has for other equipment.

It is expected that the plant will employ 500 to 800 people when it is in full operation, with an annual payroll of about two million dollars.

AMERICAN POTASH ADDS TO LINE

American Potash & Chemical Corporation has announced that sodium pentaborate and potassium pentaborate have been added to the company's line of chemicals for industry and agriculture.

Sodium pentaborate is an exceptionally soluble borate and in demand particularly for weed killing, cotton defoliation and fireproofing compositions.

Potassium pentaborate was developed principally for use in glass, enamel and ceramic industries. It is designed especially for use in the manufacture of products requiring high boron oxide and potassium oxide content particularly where sodium oxide is objectionable.

GERMAN PRODUCTION OF GLASS AND GLASSWARE, AND EXPORT TO THE U. S. A.

By ERWIN STEIN
Berlin-Wilmersdorf, Germany

Figures for the German glass industry for 1950 show that the value of product reached a total of $113,000,000. Domestic consumption accounted for 93%, and 7% was exported. The proportion exported has increased since 1950.

General statistics for the industry are presented in Table I. Analysis of these numbers indicates that the average German glass plant employs 147 persons, and that the average of wages and salaries is $680 per year. The value of product is $2,500 per person employed. (Editor's Note: In comparison, 260 American plants employ 130,000 workers, earning $400,000,000 and making $1,000,000,000 worth of product. The American glassworker earns $3,000 per year and is paid 40% of the value of his product, as against 27% paid to the German worker. These comparisons contain food for thought.)

TABLE I

Statistics for the German Glass Industry, 1950

Number of plants	306	
Number of people employed	44,989	
Total working hours (in million)	85.4	
Gross amount of wages		$25,800,000
Gross amount of salaries		4,800,000
Value of production		113,000,000
Export turnover (7% of total production)		7,900,000
Production Detail		
A. Products from melted glass		
flat glass		33,300,000
hollow ware		52,000,000
tubing		4,600,000
glass fibers		2,500,000
B. Products fabricated from glass		
lamp-working products		2,700,000
small glasswares		700,000
other processed glass		400,000
C. Glass, ground or decorated		
flat glass		13,100,000
hollow ware		2,600,000

TABLE II

Exports of Glass and Glassware

Year	*Tons*	*Value*
1951	107,220	$28,000,000
1950	46,170	12,600,000
1937	149,690	
Exports to the U.S.A.		
1951 (pro-rated for full year)	6,360	5,200,000
1950	1,950	1,980,000
1931	5,120	3,400,000

Certain explanations are in order concerning Table II. The total value of exports comes out higher than the figures shown in Table I, because the latter does not include production in the French-Occupied Zone, whereas this production is included in the export statistics. Also, because of a change in tariff regulations on October 1, 1951, the figures for export to the U.S.A. are given for only the first nine months of 1951. Pro-rating these figures for the rest of the year brings out a better comparison with 1950.

It is apparent that exports increased sharply in 1951 over 1950, both in quantity and value. However, exports are still nearly 30% under the pre-war (1937) figure.

The U.S.A. takes by far the largest share of German glass exports, more in value than The Netherlands and Switzerland, which come in second place, and more than the total of the 10 other countries reported. A variety of products is shipped to the U.S.A.: flat glass, mirrors, household glass both plain and cut, illuminating glassware, and especially large quantities of trinkets and artificial gems.

TABLE III

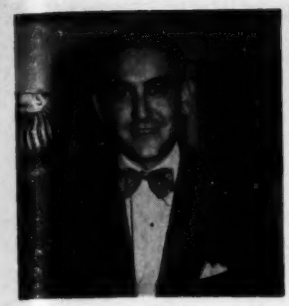
Exports to All Countries, Jan.-Sept., 1951

Country	*Tons*	*Value*
U.S.A.	4,760	$4,002,400
Netherlands	16,500	2,126,400
Switzerland	3,530	1,617,600
Great Britain	3,280	1,562,400
Belgium-Luxembourg	8,670	1,269,600
Denmark	8,900	1,080,000
Italy	3,820	981,600
Sweden	2,350	940,800
Turkey	4,520	583,200
Columbia	3,270	580,800
Canada	2,900	576,000
Argentina	1,100	513,600
Australia	710	376,800
Norway	940	350,400
Indonesia	2,840	316,800
Venezuela	1,030	292,800
Iran	2,340	280,800
Greece	540	249,600
France	1,520	240,000

PENNSALT AND SHARPLES TO COMBINE RESEARCH GROUPS

The Research Department of Sharples Chemicals, Inc. will be integrated with the Research and Development Division of the parent company, Pennsylvania Salt Manufacturing Company.

The Whitemarsh Research Laboratories' facilities are being considerably extended by the conversion of additional rooms to laboratories and rearrangement of existing facilities to provide not only for the addition of Sharples research personnel but also to increase Pennsalt's facilities.



L. G. Farber

S. L. Davis

NEW CERAMIC PUBLICATION INTRODUCED

Louis G. Farber and Spencer L. Davis have resigned positions on the executive staff of the American Ceramic Society to become the publishers of *Ceramics Weekly*, a magazine they will introduce to the art, craft and hobby branches of the ceramic field.

Mr. Farber, who is Editor of the new publication, was the Society's Technical Secretary and Associate Editor of the *Journal of the American Ceramic Society*. Mr. Davis, former Assistant Secretary of the Society, will serve as the new publication's Advertising and Business Manager. Editorial offices of the publication are located at 3493½ North High Street, Columbus, Ohio.

CORNING MUSEUM OPENS FIFTH EXHIBITION

The exhibition originally prepared by Professor Russell Hitchcock of Smith College, with the cooperation of the Massachusetts Institute of Technology, has been installed in the special gallery of the Corning Museum of Glass.

This display describes the complete story of the great London exhibition of 1851 and the famous Crystal Palace in which it was housed. The contents of the Crystal Palace are represented by the famous Dickenson color lithographs picturing the great displays from each contributing country. Also on display are numerous objects of art, water colors and a collection of Victorian glass.

OWENS-CORNING TO SPONSOR ARTHUR GODFREY TIME

Promotion of Fiberglas materials and products used in the American home will get added publicity from the daytime Arthur Godfrey show. Starting September 2, and continuing for 13 weeks, several quarter-hour portions of the show, reaching 28 television and 186 radio stations, will be sponsored by Owens-Corning Fiberglas Corporation.

Designed to give added support to the continuing merchandising and advertising program of Owens-Corning through all media, the show will send the Fiberglas story to an audience of 12 million each week. Among the products to be Godfrey-sponsored are Fiberglas insulations for new and existing homes, Fiberglas marquisette curtains and draperies, Fiberglas Dust-Stop air filters, and Fiberglas insulations for home appliances.

• The appointment of Robert F. Bourne as General Sales Manager of the Claymont Steel Corporation, subsidiary of The Colorado Fuel and Iron Corporation, has been announced.

CANADIAN GLASS NEWS

The Canadian Pittsburgh Industries Limited has acquired the assets and facilities of Hobbs Glass Limited of Canada, with the latter serving as merchandising unit of the company with headquarters at Toronto, Ont., and headed by F. W. P. Jones as President of Hobbs Glass Limited. F. J. Doyle will be General Manager of the Division which at present has 50 branch units throughout Canada.

The Pennvernon Division of Canadian Pittsburgh Industries Limited will be the window glass manufacturing unit. Jean M. Peeters will continue as General Manager in charge of production, and sales will be directed by J. de Bruyn Kops, General Sales Manager.

The Canadian Government reports that the average weekly wages and salaries in the glass and glass products manufacturing industry across the nation are continuing to advance, with latest survey revealing such payments increased to $55.91 on April 1 this year against $55.02 on March 1 and $49.93 on April 1 last year, with average hourly earnings being 122.5¢, 121.5¢ and 108.4¢ respectively on these dates. Of employees reported at April 1 this year, 83.1% were men and 16.9% women, whereas a year ago on same date men comprised 83.6% and women 16.4%.

TWO NEW VICE-PRESIDENTS ELECTED BY PPG

Two new vice-presidents have been elected in an executive reorganization of Pittsburgh Plate Glass Company's manufacturing, merchandising and glass sales divisions, it has been announced.

David G. Hill, General Superintendent of plate glass factories since 1940, has been promoted to Vice President in charge of glass manufacturing. Wallace R. Harper, Manager of plate glass sales, was named Vice President in charge of glass sales.

Ralph V. Reisgen, an assistant plant superintendent, will succeed Mr. Hill, and William A. Gordon will replace Mr. Harper, whom he formerly assisted.

Thomas G. Wright, formerly Mr. Hill's assistant, has been promoted to the newly created post of general superintendent for fabricating. Paul A. Ketchum becomes manager of trade sales, while Robinson F. Barker has been named assistant to the president.

PITTSBURGH CORNING NAMES PRODUCT DEVELOPMENT ENGINEER

Jack Binder has joined the Research and Development Division of the Pittsburgh Corning Corporation, according to a recent announcement. Mr. Binder will act as Product Development Engineer, specializing on Foamglas.

Mr. Binder was formerly associated with the A. M. Byers Company as Manager of the Engineering Service Department. His background includes work in the fields of sales promotion, personnel training, technical writing and construction techniques concerning product application and fabrication.

• A new multi-million dollar plant, more than 500,000 square feet in size and employing 2,500 people, will be built in Raleigh, North Carolina, by Westinghouse Electric Corporation, according to a recent announcement.

Inventions and Inventors

Feeding and Forming

Insulator Forming Machine. Fig. 1. Patent No. 2,602,-269. Filed Feb. 18, 1947. Issued July 8, 1952. Two sheets of drawings. Assigned to Pilkington Brothers Limited, Liverpool, England by John E. Wilcock.

This machine is for the purpose of forming an undercut socket in pressed insulators or other pressed glass articles. The figure, which is partly in section, shows an insulator A which has been pressed in a mold C with a tapered socket having straight walls. The undercut at B has been formed by the lower end of the stick 1 mounted in a universal bearing 3 carried by a frame 5. Gears 6 and 7 are driven by a motor and the arrangement is such that the stick 1 is rotated about the center of the ball 2 of the universal bearing as soon as the stick is deflected from a vertical position.

The stick is progressively deflected under the control of a cam 12, this movement being limited by a bush 17. Thus the lower forming end of the stick gradually moves outward and shapes the undercut with a rolling action until stopped by the bush 17. Of course this operation takes place while the glass is still soft.

The patent contains ten claims on both the method and apparatus and six references were cited: 650,433, Stewart, May 29, 1900; 1,407,550, Lapp, Feb. 21, 1922; 1,553,356, Bennett, Sept. 15, 1925; 1,960,045, Batschuk et al., May 22, 1934; 22,172, Australia, Apr. 10, 1935; and 105,182, Austria, Jan. 10, 1927.

Insulator Forming Machine. Patent No. 2,602,270. Filed Aug. 6, 1947. Issued July 8, 1952. One sheet of drawings, none reproduced. Assigned to Pilkington Brothers Limited, Liverpool, England by J. E. Wilcock and G. H. Baillie.

This device appears to be adapted for use in a machine having somewhat the same structure as shown in the preceding patent. The patent shows a stick for forming an undercut like that in the other patent but the means for actuating the stick are different. The first patent provided a forming stick which molded the glass by a predetermined pressure; that is, the molding movement was controlled by the rate at which the glass deformed. In this invention, there is a positive movement of the stick which is said to have certain advantages.

The patent contains three claims and the references cited were 1,553,356, Bennett, Sept. 15, 1925; 1,567,027, Bennett, Dec. 29, 1925; and 596,019, Great Britain, Dec. 24, 1947.

Method of Feeding. Patent No. 2,596, 990. Filed Nov. 23, 1949. Issued May 20, 1952. No drawings. Assigned to Corning Glass Works by Charles W. Doyle.

It is well-known that in automatically pressing glassware, there is a tendency for haze patterns to show up in the finished ware. This seems to be caused by the fact that the charge hits the mold in the same spot every time. This invention overcomes this difficulty to a great extent by either turning the mold 15 to 30 degrees after each delivery or by shifting the delivery trough slightly after each delivery. In this way each successive charge hits the mold in a slightly different spot. This results in greatly improved ware.

The patent contains five claims and the references cited were 2,015,219, Gray et el., Sept. 24, 1935 and 2,162,800, Crimmel, June 20, 1939.

Suction Forming Machine. Fig. 2. Patent No. 2,602,-271. Filed March 9, 1949. Issued July 8, 1952. Three sheets of drawings. Assigned to Developpements et Creations d'Appareils Industriels S. A. by Robert E. Comte, both of Switzerland.

The object of this invention is to avoid the difficulty caused by repeatedly dipping a suction mold into contact with a pool of molten glass in the same spot. This difficulty, which is overcome in the Owens type machines by the revolving pot, has been encountered in unit type machines where a single set of molds are positioned so that

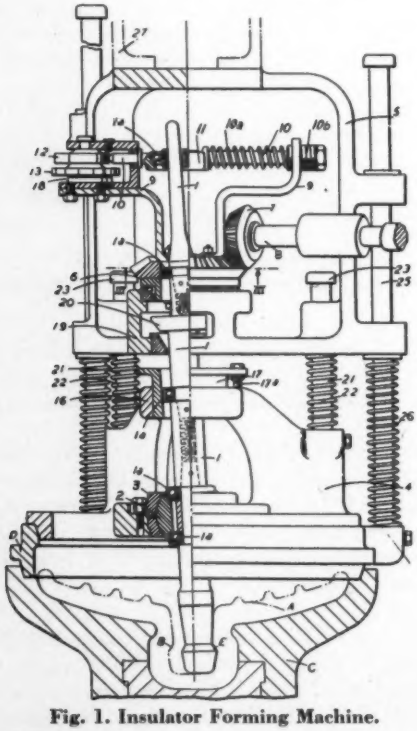


Fig. 1. Insulator Forming Machine.

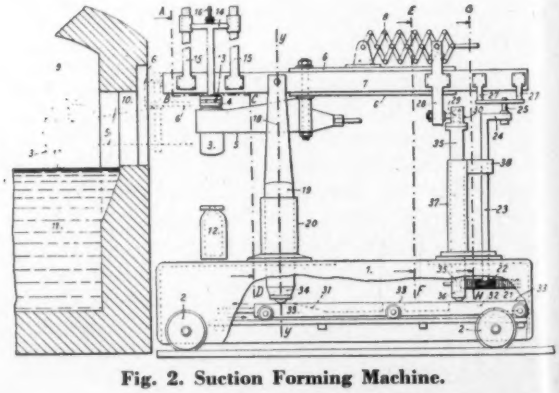


Fig. 2. Suction Forming Machine.

the suction mold is projected through an opening in the furnace wall to gather the glass.

In this machine the suction mold 3 is mounted on a carriage 6 and the mold is projected into and withdrawn from the furnace by a lazy-tongs 8. The carriage slides on guide-bars 7 which are carried by a column 19, this column being rotatable and vertically movable in a base 20. When the mold has been advanced toward or into the furnace, as shown by the dotted lines, a rack and pinion turns a crank 24 so as to swing the guide-bars 7 and the mold to the right for the first gathering and then to the left for the second, thus giving the chilled spot on the glass time to reheat before the second gathering takes place at the same place. The mold is raised and lowered by a sliding cam 33.

The patent contains two claims and the references cited were 154,919, Slayter, Sept. 8, 1874; 2,150,637, Schutz, Mar. 14, 1939; 2,425,592, Bowe, Aug. 12, 1947; 65,355, Norway, Oct. 19, 1942; 119,749, Great Britain, Oct. 17, 1918; and 612,033, Great Britain, Nov. 8, 1948.

Glass Compositions

Green Opal Glass. Patent No. 2,599,349. Filed May 23, 1947. Issued June 3, 1952. No drawings. Assigned to Libbey-Owens-Ford Glass Company by Richard W. Ricker.

This patent has two claims as follows: (1) A green colored opal glass having substantially the following calculated composition:

	Per cent
SiO_2	66.80
Fe_2O_3	.03
Al_2O_3	3.15
TiO_2	.01
CaO	4.80
BaO	.80
ZnO	3.20
Na_2O	13.70
K_2O	1.87
B_2O_3	.79
Sb_2O_5	.27
Cr_2O_3	.05
V_2O_5	.45
F_2	7.03
$O_2 \Rightarrow F_2$	—2.95

(2) A green colored opal glass containing about 0.5% vanadium pentoxide and about .05% chromic oxide.

There were seven references cited: 1,332,058, Musiol, Feb. 24, 1920; 1,572,625, Taylor, Feb. 9, 1926; 1,754,182, Taylor, Apr. 8, 1930; 2,068,801, Hood et al., Jan. 26, 1937; 2,219,122, Weidert, Oct. 22, 1940; 2,237,042, Truby, Apr. 1, 1940; and 2,475,470, Bennett et al., July 5, 1949.

Tube and Cane Machines

Tube Sizing Machine. Fig. 3. Patent No. 2,601,744. Filed March 18, 1947. Issued July 1, 1952. Two sheets of drawings. Assigned to James A. Jobling & Company, Ltd., Sunderland, England, by Samuel J. Everett.

The purpose of this machine is to reform tubing so as

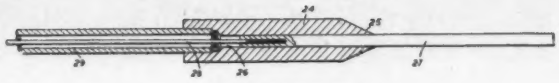


Fig. 3. Tube Sizing Machine.

to obtain a tube having a small bore of accurate size and having a smooth interior surface. This is accomplished by the use of a novel mandrel and method of using it. The apparatus for holding the tube to be reformed and the mandrel may be more or less like that shown in Patent No. 2,393,979 which includes chucks for holding the tube, passing it through an oven to soften it and then drawing it over a mandrel to size the interior. The figure shows the particular form of mandrel used in one embodiment of the invention.

The mandrel has a large cylinder 24 tapered at its forward end at 25 and having a bore 26 in which the small diameter part 27 of the mandrel slides. This part is driven by a rod 28 and the larger part 24 is connected to a driving tube 29. Mechanism is provided by which part 27 of the mandrel is rapidly reciprocated through a distance of perhaps between $\frac{1}{32}$ and $\frac{3}{16}$ of an inch at a rate between 30 and 3,000 strokes per minute. The softened tube is drawn over this mandrel to the right in the figure while the part 27 is reciprocated rapidly. This produces a finished tube having a smooth bore of accurate dimension. A bore of non-circular shape can be made by a mandrel having the proper cross-section.

The patent contains two apparatus claims and six on the method. The references cited were 2,393,979, Everett, Feb. 5, 1946; 2,396,635, Bogoslowsky, Mar. 19, 1946; 2,502,312, Danner, Mar. 28, 1950; and 339,503, Germany, July 26, 1921.

Miscellaneous Processes

Machine for Making Flanged Tubes. Fig. 4. Patent

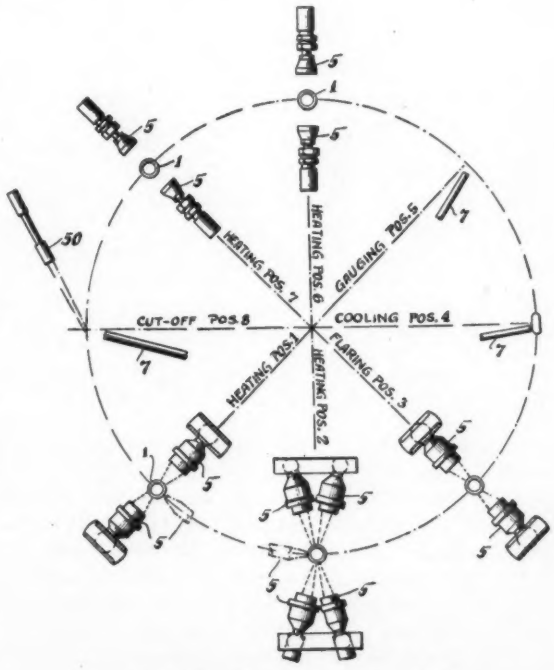


Fig. 4. Machine for making Flanged Tubes.

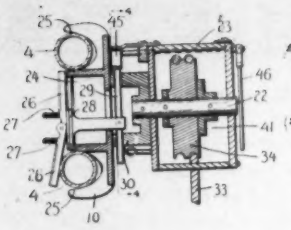


Fig. 5. Lamp Sealing Machine.

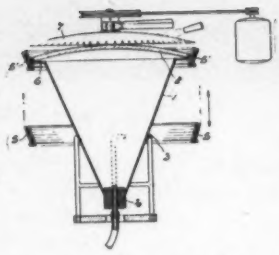


Fig. 6. Sealing Cathode-ray Tubes.

No. 2,596,899. Filed May 29, 1948. Issued May 15, 1952. Twelve sheets of drawings. Assigned to Kahle Engineering Company by Louis C. Kahle.

This machine forms short lengths of tubing having a flange or flare at one end and sometimes a narrow opening at the other end. These are made from long lengths of tube and are used in radio tubes, incandescent lamps and like articles. The machine is of the intermittent turret type having eight stations or positions. At position 1 the lower end of a length of tubing is heated by burners 5, which operation is continued at position 2. At position 3 the end of the tube is flared while the heating is continued by the burners 5. At position 4 the tube is cooled by air from a nozzle 7 which is continued at position 5 where a gauging operation takes place. This determines the length of the tube to be formed.

Positions 6 and 7 are heating stations and position 8 is where the flare is cut off from the length of tubing. If the end opposite the flare is to be formed, this is done later. It will be apparent that a satisfactory abstract cannot be made of a patent of this size.

The patent contains 19 claims and 15 references were cited.

Lamp Sealing Machine. Fig. 5. Patent No. 2,597,283. Filed June 30, 1949. Issued May 20, 1952. Three sheets of drawings. Assigned to Sylvania Electric Products Inc., by Joseph H. Brooks.

This invention is directed particularly to a device for inverting lamp bulbs after one end has been sealed. The figure shows a section of the inverting mechanism in which a lamp holder 24 is provided with two lamp receiving grooves 25 where the lamp 4 is held by spring-pressed fingers 26. Operating mechanism is provided by which the holder 24 is moved into operating position with one of the sealing heads on the machine, picks up a lamp bulb 4, turns it through 180 degrees by means of the cable 33 and replaces it in the sealing head in inverted position. The lamp is then in proper position for further operation.

The patent contains eight claims and no references were cited by the Patent Office.

Sealing Cathode-ray Tubes. Fig. 6. Patent No. 2,598,286. Filed Aug. 14, 1950. Issued May 27, 1952. One sheet of drawings. J. G. W. Mulder and Theodorus Hagenberg, Eindhoven, Netherlands, assignors to Hartford National Bank and Trust Company, Hartford, Conn.

This is a method of sealing glass windows to a metallic cone of a cathode-ray tube as used in television sets. The metallic cone 1 has a flange to be sealed to the glass window 2. A rubber stopper 4 closes the bottom opening of the tube and it is connected to a pipe for admitting nitrogen. A high-frequency coil 5 surrounds the edge of the cone and heats the edge of the cone and also the window 2, this being assisted by a heat radiating screen 7. The screen has radial slits and it is also heated by a burner. The coil is gradually raised and the glass is sealed to the metal after which it may be removed for further treatment.

The patent contains three method claims and the references cited were 1,301,714, Kueppers, Apr. 22, 1919; 2,048,556, McArthur, July 21, 1936; 2,296,307, Power, Sept. 22, 1942; and 2,359,501, White Oct. 3, 1944.

Method of Making Cellular Glass. Patent No. 2,596,659. Filed May 15, 1949. Issued May 13, 1952. No drawings. Assigned to Pittsburgh Corning Corporation by Dominic D'Eustachio.

Patent No. 2,123,536 to Long discloses a method of making cellular glass by the introduction of a gas-producing agent into finely pulverized glass. This method produces a glass in which the cells are sealed from each other and this is satisfactory for some purposes. For other purposes it is desirable that there be communication between the cells. In this respect the present invention is an improvement over the Long patent by applying fluid pressure to a body made by the Long method so as to break down the weakest point separating the cells thus providing a porous structure which can be used for sound-absorbing, filtering mediums and so forth.

The fluid pressure may be gaseous or liquid. Pressures not over 1,500 pounds per square inch will be sufficient. Duration of the pressure is about 15 or 20 minutes. The product thus obtained has good mechanical strength and can be cut in the same way as before treatment.

The patent contains seven claims and the references cited were 2,114,546, Slayter, Apr. 19, 1933; 2,237,032, Haux, Apr. 1, 1941; and 2,369,057, Leary et al., Feb. 6, 1945.

STANDARDIZATION PROGRAM ANNOUNCED AT MELLON INSTITUTE

A Fellowship for conducting systematic studies of standardization and its applications in science, engineering, production and marketing has been announced by Dr. Edward R. Feidlein, President of Mellon Institute.

This Fellowship will be sustained at the Institute by a grant from the Sarah Mellon Scaife Foundation of Pittsburgh and its projects will be organized and supervised by Dr. Dickson Reck, Advisory Fellow. Dr. Reck will work in cooperation with research specialists of the Institute and with national authorities and societies.

FOOTE MINERAL RECEIVES LITHIUM CERTIFICATES OF NECESSITY

Foote Mineral Company has announced receiving two certificates of necessity covering production of lithium chemicals as a portion of the 10 million pound per year goal set recently by the defense Production Authority.

One certificate for $2,515,000 carrys an 80 per cent amortization and covers production of lithium chemicals at Sunbright, Virginia. The other certificate in the amount of $144,828 carrys a 70 per cent amortization and covers the mining of Spodumene concentrates at Kings Mountain, North Carolina.

Electrical Heating in Glass Production

During the past three years, important progress has been made in the application of electricity to the processes of melting glass in large industrial furnaces. E. Meigh describes these advances in the March 1952 issue of *The Times, Review of Industry*, London, England.

Attention has been called to the developments which had been made in the use of electric energy for glass melting in Switzerland and France during the war. The method used was to pass an electric current through the molten glass and so generate heat in the body of the glass by the Joule effect. At that time it was not widely appreciated that, under certain conditions of temperature, glass may become a good conductor of electricity instead of the good insulator it is well-known to be when cold.

The application of electricity for glass melting has since then been greatly extended, the technique improved and further studies made of the underlying principles. One physical property, which required special investigation, was the electrical resistance of various types of glass and the change of resistance with temperature throughout the melting range.

In certain glasses the resistance decreases quite rapidly with increasing temperature. This effect means that for a given applied voltage in the bath of glass the resulting electric current increases rapidly as the temperature of the glass rises and would get out of control in the absence of some means of regulating it. The term "self de-regulating" has been used to describe the phenomenon of this progressive increase of current with temperature, and in order to control this tendency ingenious regulators have been devised for providing stepless adjustment of voltage.

In practice it is found convenient to work to a constant notional electrical resistance in the glass bath, calculated by dividing the voltage between phases by the average current passing between electrodes, and an instrument termed a "logometer" has been constructed to record this quotient. The logometer is included on the instrument panel, together with a wattmeter and suitable ammeters and voltmeters.

Where high cost prohibits the all-electric melting of glass the only economical way of using electricity is as an auxiliary to the customary fuels, coal or oil, and by adopting what is known as the "boosting" method. The output of an existing tank furnace operating normally with flame melting can be boosted substantially by introducing in the form of electric energy a comparatively small increment, say 5 per cent of the total heat units consumed; in certain circumstances it might be convenient to use less coal or oil.

The electric current is led into the glass through fairly large graphite electrodes, usually from six to 10 in. in diameter, provided with suitable cooling boxes and fitted into holes prepared in the refractory blocks constituting the walls or bottom of the tank furnace. Preferably, the electrodes pass up through the bottom blocks but when these blocks are not accessible from below the electrodes may be passed through the side walls of the furnace.

In practice it has proved possible to increase the output of existing tank furnaces by 50 per cent and more, and at the same time improve the quality of the glass. The explanation of this suprising result is that the heat introduced by the Joule effect enters the mass of the glass directly and is all utilized in the melting process, not wasted in heating the furnace superstructure or lost in waste gases. Of even greater importance is that the electrical heat produces useful convection currents which cause the cooler portions of glass near the bottom of the furnace to rise to the surface and receive there the benefit of direct radiation from the flame heating.

The melting efficiency of boosted furnaces ranges from one ton of glass melted for every 7 sq. ft. of melting area to one ton for 4 sq. ft. of melting area. Similar efficiencies have been obtained using combustible fuels, but at the expense of heavy fuel consumption and short furnace life because of the excessive temperatures to which the surface glass and the furnace superstructures have to be raised.

The powerful stirring effect of the convection currents created by electric heating tends to cause uniformity of temperature throughout the body of glass and to make it physically homogeneous. Hence, there is a marked improvement in the quality of the glass.

Boosting with electricity introduces heat directly to the lower layers of glass and the furnace becomes hotter at the lower levels than when heated only by flames. The radiant heat from the flames has to penetrate the body of glass from the surface. It is true that the higher temperature of the lower layers increases the heat losses through the lower parts of the tank blocks, but this effect is more than offset by the greatly reduced losses, for each ton of glass melted, through the superstructure, flues, and waste gases. The interesting result follows that the extra glass melted absorbs no more than the number of heat units theoretically necessary for the melting process, as the heat losses have already been fully compensated from the heat energy provided by the flames. It may even appear that the additional glass has been melted with a consumption of less than the heat units theoretically necessary, because of the better use made of the flame heating and the lowering of the temperature of the superstructure.

Consequently, it is more economical from the point of view of coal consumption to use it to produce the electricity required for boosting instead of directly for flame-heating the glass. Thus a normally efficient glass tank furnace fired with producer gas consumes about half a ton of coal for every ton of glass melted. An exceptionally high furnace performance is one ton of glass for 0.4 tons of coal. If good quality British coal is used to produce electricity in a normally efficient power station, 1.25 lb. is consumed in generating 1 kWh unit of electric energy. Allowing for coal of lower quality and losses, an average figure may reasonably be taken of 1.40 lb. coal for each kWh generated. In the boosting process 600 kWh or less will melt one ton of ordinary soda-lime glass, assuming that the normal proportion of cullet (waste glass) is being used.

It therefore follows that 840 lb. of coal converted into electricity will suffice to melt one ton of glass compared with half a ton (1,120 lb.) of coal needed to melt one ton

of glass when the coal is converted into gas in a gas-producer. There is thus a saving of 280 lb. of coal or 25 per cent for each ton of glass melted. Even exceptionally efficient furnaces may show a saving of coal of 7 per cent or more for every additional ton of glass obtained by boosting in excess of the maximum output of flame melting.

Another advantage of the electrical melting of glass, which is of special interest at the present time on account of the severe shortage of selenium, is that substantially less selenium is required in the decolorization of tank-melted glass to produce colorless glass containers. In factories where two furnaces, side by side, produce colorless containers from the same batch mixture, one using electric melting, the other not, a definite contrast in color is visible at the outset. The products of the electric melting furnace show a pink tinge when those of the other furnace may be colorless or slightly green, and therefore the amount of selenium required in the charge of the electrically heated furnace is less. In one factory in France it is claimed that by using electric melting, the consumption of selenium has been reduced in the ratio of 7 to 4.

At first when graphite electrodes were proposed for leading the electric current into glass furnaces, glass manufacturers were afraid of contamination, well knowing that it is customary to use carbon with sulphur to produce amber colored glasses. Experience has shown, however, that when the graphite electrodes are immersed in the glass and out of contact with the unmelted raw materials, there is practically no attack on the electrodes and their life is extremely long. In fact, the use of graphite in these modern electric furnaces has provided evidence that graphite is more resistant to the attack of molten glass than any of the other refractories used in glass manufacture.

Progress has also been made in the technique of combining flame combustion for the preliminary melting of the raw materials with the use of electricity in a separate compartment for the refining operation. This method is sometimes referred to as "deferred" melting. The raw materials are melted in the usual form of melting chamber at a relatively low temperature. The glass then passes to a refining cell of small dimensions, usually less than 6 ft. long by 3 ft. wide, where electric energy is applied. Powerful convection currents, which rapidly homogenize the glass, develop, and a product of high quality is delivered to the working forehearth ready for fabrication by automatic machines.

One interesting aspect of this development is that because of the intense mixing which takes place in the cells, coloring materials may be added at the point of maximum mixing and become absorbed uniformly throughout the mass of glass. So, from one basic glass, different colored glassware can be produced simultaneously. The change from one color to another can be made with extreme rapidity because the capacity of the cell is quite small in relation to the total throughput of glass. A cell of this type may refine, and if necessary color at the same time, as much as 24 tons of glass a day, and requires only a small in-put of electric energy of the order of 150 to 200 kWh.

The principal disadvantage of this method is that, on account of the large output of these small cells, there is much erosion of the refractory blocks of which they are built, although the wear attributable to each unit of glass passing through a cell is below the normal figure for the remainder of the tank. The life of the cell is only five or six months when producing output at the rate of about 24 tons of glass a day and, therefore, arrangements have to be made for repairing a worn cell as quickly as possible. During repairs the glass from the furnace continues to flow through the other cell or cells so that the furnace is not shut down although output is reduced.

GENERAL REFRACTORIES COMPLETES NEW STEEL SILO FACILITIES

Steel silo storage facilities were recently completed for indoor stockpiling of chrome ore at the General Refractories Company's Baltimore Works. Chrome ore, a major raw material in the manufacture of basic refractory brick, previously had been stored out of doors, exposing it to the elements which necessitated additional mechanical and manual handling preparation processes before it was ready for brick making.

The 20 new silos are constructed in two rows of ten, each measuring 30 feet high and 20 feet in diameter with a storage capacity of 750 tons. The five feet of space between each silo also has been utilized for storage by connecting the tanks with steel siding, providing nine additional compartments and boosting total storage capacity to approximately 20,000 tons.

PENNSYLVANIA CERAMICS ASSOCIATION HOLDS ANNUAL MEETING

The Pennsylvania Ceramics Association, Inc., held its seventh annual spring meeting at the Mineral Industries Building, Pennsylvania State College, June 27 and 28.

Following a morning technical session, the afternoon of the first day was devoted to a golf tournament, bridge and other recreation. A banquet and entertainment followed.

The gathering closed with a second technical session and regular annual business meeting on the second day.

Among the papers presented in the two-day technical session program were: "Recent Developments in Fiberglas" by Dr. A. W. Davison, Director of Research, Owens-Corning Fiberglas Corp., and "How the Chemical Supplier Serves the Ceramic Industries," W. W. Coffeen, Research and Development Laboratories, Metal & Thermit Corporation.

GLASS FIBERS SUBSIDIARY FORMS NEW UNIT

Formation of the Aero-Coustic Division of Vibradamp Corporation, a subsidiary of Glass Fibers, Inc., has been announced by F. H. May, Jr., President of Vibradamp.

The new division, with headquarters in Burbank, California, will custom engineer, design and fabricate specialized thermal and acoustical insulation materials for aircraft and a wide range of industrial products.

Heading the new unit will be M. D. Worcester, who also has been elected a Vice President of Vibradamp.

Current Statistical Position of Glass

Employment and payrolls: Employment in the glass industry during May 1952 rose slightly and was a preliminary 123,600. This is .7 per cent higher than the adjusted 122,700 persons employed during April. During May 1951 employment was 130,900, or 5.5 per cent more than for May this year.

Payrolls during May also rose and were reported to be a preliminary $35,735,232. Compared with the previous month's adjusted figure of $34,735,961, a rise of 2.8 per cent is shown. During May 1951 payrolls were $37,148,111. This is 3.8 per cent higher than for May this year.

GLASS CONTAINER SHIPMENTS

(All Figures in Gross)

	June 1952
Narrow Neck Containers	
Foods	914,958
Medicinal & Health Supplies	971,924
Chemicals, Household & Industrial	618,189
Beverages, Returnable	1,069,385
Beverages, Non-returnable	53,811
Beer, Returnable	358,910
Beer, Non-returnable	839,130
Liquors	610,911
Wines	240,663
Toiletries & Cosmetics	515,350
Sub-total (Narrow)	3,414,074
Wide Mouth Containers	
Foods	*2,560,070
Dairy Products	213,561
Medicinal & Health Supplies	260,881
Chemicals, Household & Industrial	121,083
Toiletries & Cosmetics	112,097
Packers' Tumblers	146,382
Sub-total (Wide)	3,414,074
Total Domestic	9,607,305
Export Shipments	243,160
TOTAL SHIPMENTS	9,850,465

* This figure includes Home Canning.

GLASS CONTAINER PRODUCTION AND INVENTORY

(All Figures in Gross)

		Production June 1952	Stocks June 1952
Foods; Medicinal & Health Supplies; Chemicals, Household & Industrial; Toiletries & Cosmetics	Narrow Neck	3,278,887	3,900,970
	Wide Mouth	*3,316,891	*3,115,750
Dairy Products		235,188	302,894
Beverages, Returnable		1,027,922	682,777
Beverages, Non-returnable		56,686	43,636
Beer, Returnable		381,806	298,914
Beer, Non-returnable		728,472	526,863
Liquors		599,696	757,485
Wines		280,581	298,933
Packers' Tumblers		173,528	131,827
TOTAL		10,079,657	10,060,049

* This figure includes Home Canning.

Glass container production, based on figures released by the Bureau of Census, dropped 1.3 per cent during June to reach 10,079,657 gross. This is a drop from the previous month's production of 10,219,864 gross. Production during June 1951 was 10,489,467 gross, or 3.9 per cent higher than for June this year. Glass container production for the first half of 1952 has reached a total of 56,945,785 gross, which is 9.4 per cent less than the 62,880,085 gross produced during the first half of 1951.

Glass container shipments during June 1952 also dropped off and were 9,850,465 gross. This is 2.7 per cent less than May shipments of 10,127,697 gross. During June 1951 shipments were 10,148,644 gross, or 2.9 per cent higher than for June this year. At the half-way mark of 1952, total glass container shipments have reached 55,970,836 gross. Compared with the previous year's half-way total of 59,713,475 gross, 1952 is running 6.2 per cent behind 1951.

Stocks on hand at the close of June 1952 were 10,060,049 gross, which is 1.9 per cent higher than the 9,871,257 gross on hand at the close of May 1952 and 3.5 per cent higher than the 9,714,037 gross on hand at the close of June 1951.

Automatic tumbler production during May dropped off to 4,536,844 dozens. This is 3.4 per cent less than the 4,701,238 dozens produced during April. Production during May 1951 was 7,292,106 dozens. Shipments during May 1952 were 5,329,111 dozens which represented an increase of 6.8 per cent over the previous month's shipments of 4,986,782 dozens. Shipments during May 1951 were 6,759,720 dozens. Stocks at the close of May 1952 dropped 8.2 per cent from April's stocks of 9,892,475 to reach 9,073,280 dozens. Stocks on hand at the close of May 1951 were 11,381,190 dozens.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware during April 1952 were 3,473,570 dozens. This is 1.2 per cent higher than March sales of 3,431,390 dozens. During April 1951 sales were 3,438,850 dozens. At the close of the 12-month period ending with April 1952, manufacturers' sales had reached a total of 38,438,124 dozens, which represented a 6 per cent drop from the 40,912,158 dozens sold during the corresponding period in 1951.

During May 1952 manufacturers' sales continued to rise and reached 3,551,320 dozens. This is 2.2 per cent higher than the 3,473,570 dozens sold during April. During May 1951 sales were 3,407,828 dozens. At the close of the 12 months ending May 1952, manufacturers' sales reached a total of 35,581,616 dozens. This is 13 per cent below the 40,926,484 dozens sold during the same period in 1951.

• A five-year research program on plate efficiencies in fractionating towers, a cooperative project between the American Institute of Chemical Engineers and twenty-five chemical, petroleum and engineering organizations was recently begun.

DR. G. S. BACHMAN NAMED RESEARCH HEAD OF PPG FIBER GLASS DIVISION

Dr. George S. Bachman has been appointed Director of Research for the new Fiber Glass Division of Pittsburgh Plate Glass Company, according to an announcement by J. Hervey Sherts, General Manager of the Division.

Dr. Bachman, since joining the company in 1947, has been associated with its Glass Division research laboratories at Creighton, Pa. Prior to this, he was a ceramic engineer with Owens-Illinois Glass Company and for three years during World War II served in the Army's chemical warfare division.

Dr. Bachman is a graduate of Pennsylvania State College with the degree of B.S. and M.S. in ceramics. He received his B.S.C., chemical engineering, from the University of Michigan, and his Ph.D., ceramics, from the University of Illinois.

As Director of Research for the new Division, Dr. Bachman's headquarters will be at Shelbyville, Indiana, where production facilities and laboratories are being installed for the production of strand and superfine fiber glass. Plant operations are expected to start within the next few months.

L-O-F OFFERS LICENSES FOR GLASS FISHING ROD MANUFACTURE

Royalty free, non-exclusive licenses for the manufacture of glass fishing rods have been offered to 35 manufacturers by Libbey-Owens-Ford Glass Company under its Dubois patent No. 2,571,692, according to an announcement by John D. Biggers, President.

It is believed that this action will clarify a confusing patent situation which has existed in the industry for some time.

TILING COMPANY PURCHASES INTEREST IN UNITED FELDSPAR

American Encaustic Tiling Company, Inc., Lansdale, Pa., has announced the purchase of the controlling interest, representing about 85 per cent of the stock, of United Feldspar and Minerals Corporation. As a result of this acquisition, which was made through a wholly owned subsidiary—the General Minerals Company—American Encaustic assures for itself a dependable source of raw materials for its long-range operations.

United Feldspar and Minerals Corporation operates mines in the State of Maine for the production of feldspar. It owns three mines in North Carolina producing various grades of pyrophyllite, an aluminum silicate used in the glass and ceramic industries, as well as for agricultural applications, paint and rubber.

Control of the firm was purchased from Mrs. Winifred L. Haag, former President of United. Mrs. Haag remains a member of the Board of Directors.

AMERICAN POTASH MAKES STOCK PURCHASE FROM MATHIESON

Following a 79 per cent favorable vote by stockholders of American Potash & Chemical Corporation, Peter Colefax, President, announced completion of the purchase of 120,000 shares of the company's stock held by Mathieson Chemical Corporation at a price of $40 per share. Concurrently with this purchase, the balance of 17,225 shares of American Potash & Chemical Corporation stock held by Mathieson was purchased at the same price by Lehman Brothers.

The stock retirement is being financed by a 5-year $4,800,000 loan which will reduce the company's outstanding Class A and Class B stocks by 22.7 per cent. Following the stockholders' meeting, the five directors representing Mathieson resigned from the American Potash & Chemical board.

AMSLER MORTON VICE PRESIDENT DIES

Karl W. Gass, Vice President of Amsler Morton Corporation, died at his residence after a relatively brief illness.

Mr. Gass was born in Pittsburgh in 1888. He received his early education in that city and was an alumnus of Cornell University, class of 1912.

He is survived by two daughters, Mrs. George B. McAleese, Pittsburgh, Miss Elizabeth Roberts Gass, San Francisco, and three grandsons.

BROCKWAY APPOINTMENTS

Brockway Glass Company has announced the appointment of Frederick J. Hutchison as Sales Promotion Manager. Mr. Hutchison was formerly a member of the Brockway Personnel Department. He joined the firm in November 1949 upon graduation from the University of Pittsburgh.

Thomas J. Fisher, formerly with the Sterling Division of the Quaker State Oil Corporation, has joined Brockway Glass Company as Prescription Ware Division Sales Manager.

SOLVAY DEDICATES NEW SODA ASH PLANT

The Solvay Process Division, Allied Chemical & Dye Corporation, marked completion of its new multi-million dollar soda ash plant in Syracuse, New York with dedication ceremonies and an open house for employees, friends and the general public.

The new building, embodying the latest equipment in alkali manufacturing, is the key project in the company's modernization program at Syracuse which was started at the close of World War II and has involved capital investment in excess of $20,000,000.

During dedication ceremonies, A. B. Chadwick, Solvay President, turned over to R. G. Zimmer, Plant Manager, a glass key symbolic of one of the major uses of soda ash as a basic alkali by other industries. Hugo Riemer, Executive Vice President, Carlton Bates, Vice President, H. R. Margetts, Director of Operations, and D. O. Yeoman, Director of Development of Solvay Alkali Section, also participated in the dedication.

Daily output of soda ash by the new plant would equal the amount of this basic chemical needed to produce nearly 10,000,000 quart milk bottles.

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If calcined or hydrated aluminas are important to your product's quality, you'll be in dependable hands when you order from Kaiser Chemicals.

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You'll be assured of quality that's uniformly pure . . . quality that for years has met the rigid requirements of manufacturers of abrasives, glass, ceramics, refractories, catalysts, chemicals for water treatment.

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Alumina • Basic Refractory Bricks and Ramming Materials • Dolomite • Magnesia • Magnesite • Periclase

Foamglas pipe insulation, manufactured by Pittsburgh Corning Corporation, was used to insulate a scuttlebutt, and freon and chilled water lines aboard the new ocean liner, *S.S. United States.*

THOMPSON AWARD PRESENTED TO CADILLAC GLASS EXECUTIVE

The first presentation of the Annual Thompson Award of Merit was made to Harold L. Smith, Vice President of Cadallic Glass Company, at the recent Cincinnati meeting of the Flat Glass Jobbers Association for his many outstanding contributions to the Association and to the industry which it represents.

BOOK REVIEW

Mineral Forecast 2000 A. D.

By Edward Steidle

This book is new in its field and accepts the idea of an ever-expanding United States during the next fifty years.

The book reviews our utter dependence on outside sources for many strategic and critical mineral supplies; outlines the urgent need for conservation of minerals, for down-to-earth mineral policies, for a Federal Department of Mineral Industries with a secretary of Cabinet rank; forecasts the mineral fuels, metallic minerals, and non-metallic minerals, and their discovery, extraction, preparation, processing and utilization, including water supplies and atomic energy; shows how education and research can constantly point out new directions of effort and prove that what we lack in quality resources can be offset by better brains and skills; in short, establishes a long-range goal towards which our efforts must be directed during the next 50 years. The chapter, Mineral Policies, was written verbatim into the Congressional Records, April 25, 1952.

Available through Mineral Industries Extension Services, State College, Pa., 216 pages, $3.00.

• C. R. Fay, comptroller, Pittsburgh Plate Glass Company, has been elected a director of the Pittsburgh Control of the Controllers Institute. At the annual meeting of the organization's Toledo Control, R. F. Mensing, comptroller of Glass Fibers, Inc., was renamed to the board.

• DESIGN
• ERECTION
• OPERATION

of Glass Plants

DOMESTIC AND FOREIGN

Complete Glass Plants and Equipment, Batch Systems, Glass Melting & Sodium-Silicate Furnaces, Batch Feeders, "Schmid" Mechanical Gob Feeders, "Liberty" Pneumatic Gob Feeders, Automatic Handling Equipment, Stackers, Lehrs, Machines, etc. for manufacture of containers, flat glass, pressed ware, and tubing. Furnace Repairs and Rebuilding. Process Engineers.

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MISSISSIPPI GLASS COMPANY LAUNCHES ARCHITECTURAL PROMOTION PROGRAM

Formal announcement of the creation of a new department to be known as the Architectural Promotion Division was made by Paul L. Hershfield, President of the Mississippi Glass Company during a two-day Sales and Manufacturing Conference recently held at the company's headquarters in St. Louis.

Specially trained representatives, employing a unique model daylighting demonstration unit, are now engaged in a series of meetings with leading architectural and engineering groups throughout the country. Objective of the demonstration, according to Mr. Hershfield, is to better acquaint the architectural and construction fraternity with the properties of light diffusing, translucent, figured and wired glass and its increasing importance in modern industrial, commercial and residential buildings.

INNIS, SPEIDEN PERSONNEL CHANGES

Donald S. Cushman, Vice President of Innis, Speiden & Company, has announced several staff changes at its Philadelphia Branch.

Robert P. Heron was appointed Manager of the branch. He has been associated with the company since 1917. William J. Thorn, former manager, completed his tenure of office on July 1, having been active in the company's affairs since 1912. L. E. MacKensie of the company's New York office, will assist Mr. Heron in the outside sales activities of the Philadelphia Branch.

A live blossom in a lighter combines beauty and utility in a current novelty for home decoration. The modern hostess can place a cutting from a floral bouquet in the "Rose Bowl Lighter," manufactured by Evans Company, North Attleboro, Mass. Fresh flower and water are inserted in glass bowl by unscrewing the self-contained lighter unit in the cap.

• Allied Chemical & Dye Corporation has formed a new division to be known as Nitrogen Division to take over the manufacturing and related operations of the Nitrogen and Organic Sections of the Solvay Process Division and the sales of the products involved now handled by The Barrett Division and Solvay Sales Division. The sale and other personnel previously engaged in the activities to be taken over have been transferred to Nitrogen Division and are continuing in their former capacities.

de·pend'a·ble adj. re

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Anhydrous: Technical Grade
Granular

Hydrate ($Na_2B_4O_7 \cdot 10H_2O$):
USP and Technical Grades
Regular Granular
Fine Granular
Powdered
Borax Glass (30 mesh)

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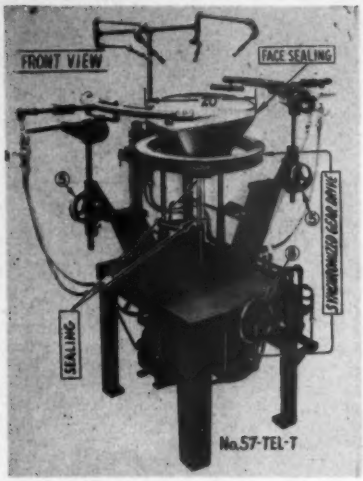
824 Wilshire Boulevard.....Los Angeles 14, Cal.
326 South Main Street .....Akron 8, Ohio
636 California Street.....San Francisco 8, Cal.
Houston, Tex. • N. Portland, Ore. •
Apopka, Fla. • Weslaco, Tex.

New Equipment and Supplies



EISLER PICTURE TUBE SEALING MACHINE

Eisler Engineering Company, Inc., 750 South 13th Street, Newark 3, New Jersey, has developed a single-position picture tube sealing machine for making picture plate seals for 12″ to 40″ round or rectangular tubes to meet the requirements of the television tube manufacturers to produce picture tubes for developing or experimental purposes.

The machine can handle the wide range of tube sizes by quick adjustment of parts (tube holder, burner manifolds) and a wide adjustment range. The table and legs carry underneath speed reducer and counter shaft, center spindle drive and the timing cam shaft. Above the table are the tube revolving head and burner stands. All burner adjustments can be performed by conveniently located hand wheels for up and down, in and out adjustment.

The operation of the machine consists of placing the metal body with picture plate into holder and starting motor. All the following phases of operation, preheating, sealing, cooling off and air support are mechanically controlled by adjustable cams and quick opening valves. Special burners with long focusing flames are used to overcome the irregular shape of the rectangular tube. This machine can also be adapted for sealing the glass neck to the metal cone and the gun to the glass neck. The finished sealed tube is removed by the operator.

ELECTRICALLY LIGHTED INDUSTRIAL MAGNIFIER

Bausch & Lomb Optical Company, Rochester 2, New York, has announced an electrically lighted magnifier for general industrial use. The instrument is designed to speed detailed examination of all kinds of materials and products through self-contained direct illumination on the object. It comes equipped with either of two types of illuminator handles, one battery-powered and the other for connection with a 110-volt power source.

The instrument's lens system magnifies five times and is highly corrected to eliminate virtually all spherical and chromatic aberration and distortion. It has a wide, flat field.

HIGH PRECISION ABRASIVE CUTTING UNIT

S. S. White Industrial Division, 10 East 40th Street, New York 16, New York, has announced the development of an Industrial "Airbrasive" unit which provides a fast, accurate method of doing a number of high precision operations, including controlled removal of metallized films from glass and ceramics, drilling thin sections of hard-to-work materials, cutting extremely hard or brittle materials, etching, light deburring and polishing.

The operation, the "Airbrasive" unit directs a gas-propelled abrasive stream against the work surface through a sintered tungsten carbide nozzle. As it leaves the nozzle, the stream travels at approximately 1100 feet per second and is only .018″ in diameter. The cutting action is accomplished without the usual increase in temperature and without the pressure and vibration ordinarily experienced with other cutting methods. Normally, a specially processed aluminum oxide powder is used as the abrasive. Any dry inert gas can be used as the propellant.

CATALOGS RECEIVED

Link-Belt Company, 307 North Michigan Avenue, Chicago 1, Illinois, has just published a new 148-page roller chain engineering data book, No. 2457, discussing the roller chain and its application. Detailed engineering information covers the selection, installation, lubrication and maintenance of roller chain for drives and conveyors, and sprocket wheels.

For reference and easy identification, the book contains a large number of photographs and line drawings of the many types and sizes of chain and sprocket wheels available in the Link-Belt precision steel roller chain line. In addition, over 50 typical conveyor chain attachments are shown. Formulas, charts, diagrams and typical problems simplify selection.

One section of 24 pages contains a comprehensive group of pre-selected drives which are available for delivery from stock. The book offers a guide to the application of stainless steel and bronze chains. Included is a table which lists the degree of resistance of these metals to 400 corrosive re-agents.

Sections on installation, maintenance and lubrication discuss such factors as shaft and sprocket wheel alignment, chain installation and chain tension, casing assembly and methods of lubrication for varying conditions.

The Cambridge Wire Cloth Company, Cambridge, Maryland, has issued a four-page folder, Bulletin No. 106, devoted to its industrial wire cloth.

The well illustrated bulletin is devoted to the applications of filtration, sizing, cleaning, straining, catalysis, dewatering and screening. Photographs illustrating the processes used in the manufacture of this wire cloth are shown.

Leeds & Northrup Company, 4934 Stenton Avenue, Philadelphia 44, Pa., has published a newly-revised and illustrated 44-page catalog, Catalog EN-S2, "Thermocuples—Assemblies, Parts and Accessories," offering the latest information on available couples and couple assemblies for general applications, plus an expanded section on special couples for plant and laboratory.

In a simplified tabular arrangement, the publication lists the accuracy limits of couples, the temperature and physical limitations of thermocouple and protecting tube materials, and the recommended protecting tube and well materials for general applications.

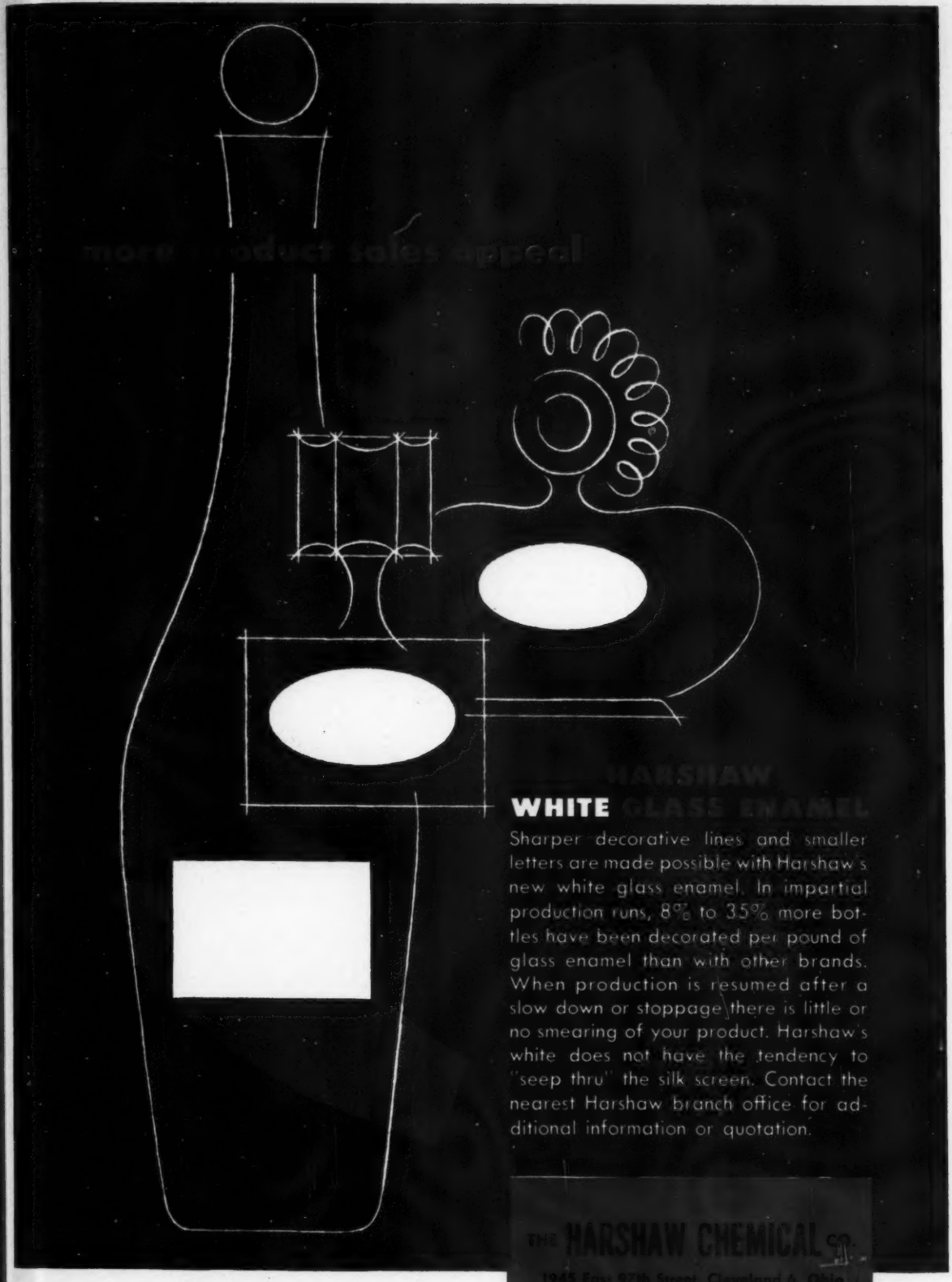
The expanded section on special couples includes those for such applications as open-hearth, glass feeder, pickling acid, steam plant and blast furnace installations. Component parts of couple assemblies—heads, tubes, elements, insulators, etc.—are fully described and illustrated.

The Foxboro Company, 26 Neponset Avenue, Foxboro, Mass., in its new 32-page bulletin, describes eight types of its Model 40 Controller. The eight basic types are Single Action, Dual, Duplex, Auto-Selector, Ratio, Relation, Pneumaticset and Time Schedule.

The new bulletin contains 114 illustrations and diagrams, helpful in understanding and applying the advanced principles of automatic control. Each instrument is pictured with a typical process diagram and a characteristic chart record. One section describes the five types of control action available with the Model 40. Control mechanisms for each type are diagrammed and explained.

Minneapolis-Honeywell Regulator Company, Industrial Division, Wayne and Windrim Aves., Philadelphia 44, Pa., has issued a new 7-page bulletin, Bulletin 1502, which covers ElectroniK cam operated program controllers.

Electric contact, electric proportional and pneumatic control forms are described. Used wherever a controlled schedule of time-temperature is required, the instrument can measure temperature, weight, strain and other variables.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GLASS ENAMEL
WHITE
Sharper decorative lines and smaller letters are made possible with Harshaw's new white glass enamel. In impartial production runs, 8% to 35% more bottles have been decorated per pound of glass enamel than with other brands. When production is resumed after a slow down or stoppage there is little or no smearing of your product. Harshaw's white does not have the tendency to "seep thru" the silk screen. Contact the nearest Harshaw branch office for additional information or quotation.
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BRANCHES IN PRINCIPAL CITIES

Use These Scales for Better Cost and Quality Control . . .

EXACT WEIGHT Scale Model #706 for table operation. Popular today for weighing large television tubes. Also used for checkweighing heavy glass containers for close tolerance. End tower design with dial in direct line for easy vision in production line checkweighing. Dial 8 ozs. over and underweight by 1 oz. graduations. High speed due to short platter fall. Capacity to 27 lbs.

Since very small glass containers demand a high degree of accuracy we recommend the Shadograph, both hot and cold end. The model #9062 (illustrated) can be built to specifications for checking the smallest glass containers now made. These scales give you better accuracy, frictionless shado indication which substitutes light projection indication for mechanical readings. Sensitivity is keen . . . too 2 Mg. All of these models are electrically operated, either DC or AC. Capacity to specifications.

EXACT WEIGHT Scale Model #88-G. Recommended for checking at the hot end. Has convenient carrying handle. Dial markings by 1/16 oz. graduations or 1 gram metric. Weighs accurately on level or out-of-level benches. Capacity to 3 lbs. or 2000 grams metric.

Sales and Service from Coast to Coast"

EXACT WEIGHT SCALES

Industrial Precision

THE EXACT WEIGHT SCALE COMPANY

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2920 Bloor St., W., Toronto 18, Canada

JOHN GREEN TO SPEAK BEFORE SWEDISH ENGINEERING CONFERENCE

John R. Green, of the Industrial Division of Minneapolis-Honeywell Regulator Company, will deliver a paper on automatic control systems before a conference of the Royal Swedish Academy of Engineering Conferences in Stockholm in September.

Mr. Green will be one of the U. S. industry authorities to address the Instruments and Measurements conference. The conference, co-sponsored by the Association of Technical Physicists, will run from September 22 to 25.

MATHIESON CHEMICAL-E. R. SQUIBB MERGE

Announcement has been made of the merger of E. R. Squibb & Sons into Mathieson Chemical Corporation. Each five shares of Squibb common stock will be converted to three shares of Mathieson common stock, thereby increasing the outstanding stock of Mathieson by 2,297,177 shares to 5,439,931 shares.

Mathieson Chemical Corporation will be the surviving corporation and will operate E. R. Squibb & Sons as a division, retaining its well-known and excellently established name.

• On July 21 to 25, the University of California sponsored the First National Conference on Clays and Clay Technology. The purpose of the Conference was to provide an opportunity for those engaged in some phase of fundamental studies of clays and clay technology to gather and share scientific and technologic knowledge, and engineering experiences.

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for raw materials

MARIETTA STORAGE TANKS

MARIETTA concrete storage tanks play an important part in the production of glass products!

In them, materials used in glassmaking such as sand, soda, potash and limestone may be safely and economically stored.

MARIETTA storage tanks keep your raw materials right, always ready to use, and reduce losses due to fire, air and moisture. You pick the size and capacity tanks you need, MARIETTA designs and erects them in any arrangement you wish for safe, efficient storage facilities to meet your present and future plans.

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SALES CAMPAIGN TO TIE IN WITH GLASSWARE JUBILEE

A nation-wide campaign to promote retail sales of moderately-priced machine-made glassware will be staged this fall with the "1952 American Glassware Jubilee" as the climax event. This year's Jubilee, scheduled for October 6 to 11, is being staged by the Glassware Institute of America, made up of the nation's eight leading manufacturers of table, kitchen and cooking glassware.

More than 5,500 stores participated in the 1951 event, the industry's first nation-wide promotion at the retail level, and spokesmen for the Institute predict an even greater and more active participation this year.

The program will include comprehensive merchandising, advertising, and publicity efforts, according to H. L. Dillingham, Secretary of the Institute.

Manufacturers will tie in their own advertising and publicity campaigns to stimulate public interest in the promotion, Mr. Dillingham said, and company and distributor salesmen will work closely with retail outlets to assure maximum benefits for their customers.

Sales aids available, free of charge, to all retail outlets will include display banners, window and interior display suggestions, radio spot announcements and scripts, ad layout suggestions and matted advertising material.

Retailers may obtain full information on material available by writing to the American Glassware Jubilee Committee, Room 1508, 247 Park Avenue, New York 17, New York.

Nature's Gift to Industry

Powdered Silica of the highest Quality results from grinding these pure Ottawa and Rockwood sands.

• The Silica Sands of Ottawa and Rockwood, purified by nature's processing over untold ages . . . mined, cleansed and graded by special refining at our plants, offers glass-makers Silica Sands of supreme quality.

ETERNAL AS THE SANDS OF TIME

Ottawa Silica Co.

Plants located at OTTAWA, ILL. ROCKWOOD, MICH.

CALUMITE...

could be the answer

During the past few years, the amber container industry has made rapid strides in quality improvement and high packs. This accomplishment didn't "just happen." It has been the result of clear thinking, well directed energy and plenty of "push."

The industry has reached a point where each additional 1% pack is the real tough one to get and hold—but this same increase represents clear profit—devoid of all overhead.

Users of Calumite have found that a just share of the improvement must be given to this material. Its use has provided higher quality—and more bottles in the carton. An entirely new concept and "know how" for the glassmaking industry has been evolved through the use of Calumite . . . it is one reason for higher packs of better amber ware.

Perhaps some of your production problems could be solved by the use of this high grade, low cost material.

The Calumite Co.
HAMILTON, OHIO

DU PONT PUBLISHES BOOK FOR 150TH ANNIVERSARY

The E. I. du Pont de Nemours & Company, celebrating its 150th anniversary this year, has published an anniversary book, "Du Pont—The Autobiography of an American Enterprise."

The book traces the company's role in the growth and development of the nation. Pictures and text sketch the broad United States social and economic patterns of the last century and a half, underscoring the company's advance to satisfy the country's expanding needs.

The beautifully illustrated book presents, among other things, full color photographs of the founders of the company and the subsequent heads of the firm from its origin up through today to C. H. Greenwalt, President. Pictorially, as well as editorially, it traces the trends of the times and the progress of America.

L-O-F FIBER GLASS STAFF ADDITIONS

J. M. Johns, for several years manager of industrial sales for Libbey-Owens-Ford Glass Company, has assumed his new duties as General Manager of the new Fiber Glass Division, according to an announcement by G. P. MacNichol, Jr., Vice President. Mr. Johns will be responsible for the general direction of the Division, including sales, production, research and development.

Robert E. Worden, of Worden & Risberg, who has been serving as General Manager of the Division during its organization and development, is withdrawing from active participation in the management but will serve in a consulting capacity.

G. O. Hartzell has joined the Fiber Glass Division for general sales duties in the central region, it has also been announced. His territory will include Ohio, Michigan, Indiana, Kentucky and parts of New York, Pennsylvania, West Virginia and Tennessee. Mr. Hartzell's background in mechanical engineering, introduction of fiber glass products and broad acquaintance in the field will, it is felt, prove invaluable.

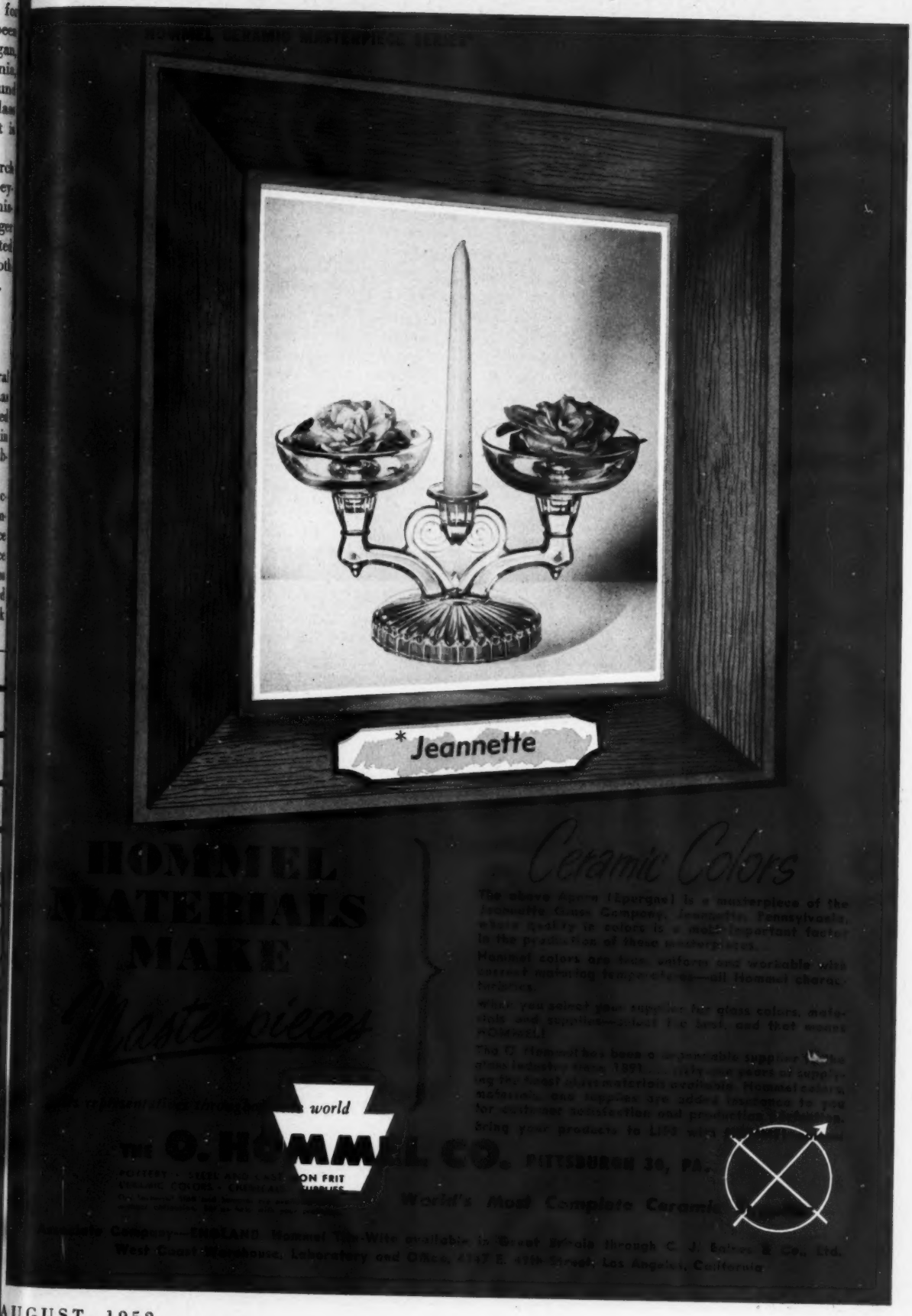
It was also announced that George J. Hannes, research analyst in the distribution research department of Libbey-Owens-Ford Glass Company, has been named administrative assistant to Herbert A. Fox, Technical Manager of the Fiber Glass Division. Mr. Hannes was selected for the assignment because of his background in both business administration and engineering, and research.

GENERAL REFRACTORIES ELECTS NEW BOARD CHAIRMAN AND PRESIDENT

Lionel Y. Greene was elected President of the General Refractories Company, and Floyd L. Greene, who has been president of the firm since 1937, has been elected to the post of Chairman of the Board and will remain the senior executive officer of the company and its subsidiaries.

Lionel Y. Greene, who has been with General Refractories since 1923, has been Vice President of the company since 1936. In 1948 he was made Executive Vice President. He has been a director of the company since 1942. Mr. Greene has been in the refractories business since 1916. He was previously associated with Standard Refractories Company and the Superior Silica Brick Company.

In container ware batch
B_2O_3*
ANHYDROUS BORAX
ANHYDROUS RASORITE
BORAX—BORIC ACID
Speeds melting rate
Speeds fining rate
Improves durability . . . appearance
Container ware manufacturers are becoming increasingly aware of the merits of B_2O_3 as a minor constituent. A primary source of supply is the Pacific Coast Borax Co. with its continuous record of supplying highest quality boron compounds for more than fifty years. One single organization—from mine to refined product—assures top grade.
PACIFIC COAST BORAX CO.
DIVISION OF BORAX CONSOLIDATED, LIMITED
MANUFACTURERS OF FAMOUS 20 MULE TEAM PACKAGE PRODUCTS
NEW YORK • CHICAGO • CLEVELAND • LOS ANGELES


* Jeannette
HOMMEL MATERIALS MAKE Masterpieces
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THE O. HOMMEL CO. PITTSBURGH 36, PA.
World's Most Complete Ceramic

PEMCO PARTICIPATES IN BALTIMORE BUSINESS-EDUCATION WEEK

During Baltimore's first business-education week, each day was devoted to a special theme. On Tuesday, it was Industry Day, with a program prepared by a committee headed by Richard H. Turk, President of Pemco Corporation.

The groups selected to visit the Pemco plant were received by Mr. Turk, as well as Herbert Turk and W. Russell Greer, vice presidents of the company. Divided into groups of 10 with a guide for each group, the teachers, who had voluntarily enrolled in the program, were shown each phase of Pemco's operation with a detailed explanation of what was taking place. After a brief recess for refreshment, the workshop group was addressed in Pemco's conference room by Mr. Greer on the topic, "How American Industry Contributes to the American Way of Life."

REPORT ON CORNING CONFERENCE PUBLISHED IN BOOK FORM

"Creating an Industrial Civilization," a report on the Corning Conference and edited by Dr. Eugene Staley, has been published by Harper & Brothers.

The book is the outgrowth of the conference on "Living in an Industrial Civilization," sponsored jointly by the American Council of Learned Societies and the Corning Glass Works in commemoration of the latter's 100th anniversary. Attended by nearly 100 scholars and men of affairs, the conference was held last year at the Corning Glass Center in closed sessions.

The book is a presentation of the main themes to emerge from the discussions as edited from the verbatim record. The illuminating, sometimes controversial, and occasionally humorous exchanges of opinion are presented in part in the form of the original dialogues.

"Creating an Industrial Civilization" contains reports on the four roundtable sessions, the two joint sessions and a concluding review. The background papers, written as guides to the discussions, are included. In addition, there is an appendix with brief biographies of Conferees, Conference officials, and Corning Glass Works executives.

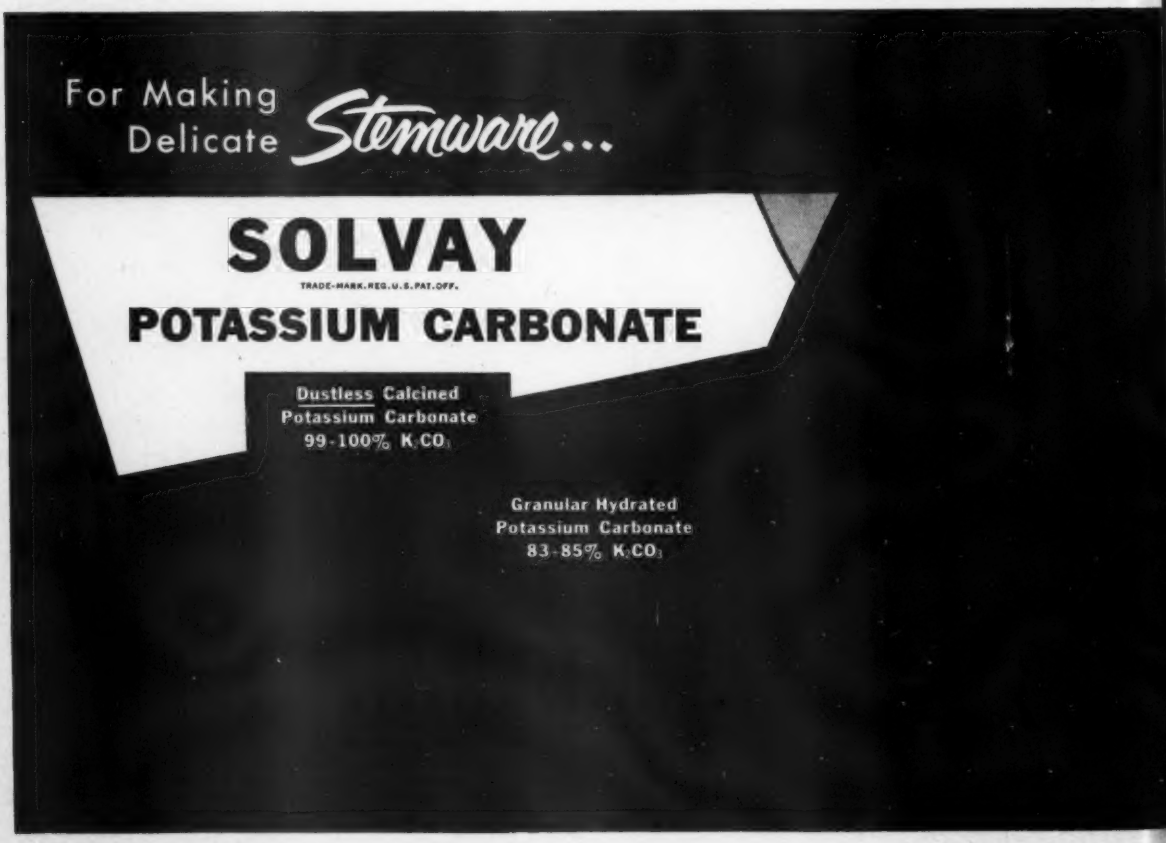
ROBERT G. EVANS FORMS NEW COMPANY

Robert G. Evans, one of the original founders of the Clipper Manufacturing Company, has announced the formation of a new company to distribute masonry and concrete sawing equipment.

The products will be marketed under the trade name "Target". Target blades will introduce an entirely new system to accurately identify blade specifications for different materials. In place of the usually complex symbols, color will be used. For example, Target gold blades will be for hard materials; blue blades for medium; and red blades for soft or abrasive products.

Headquarters for the company will be 6315 Brookside Plaza, Kansas City, Missouri.

• The recently formed Mathematical Computing Service (THE GLASS INDUSTRY June 1952) has announced its headquarters of 105 Court Street, Brooklyn 2, New York.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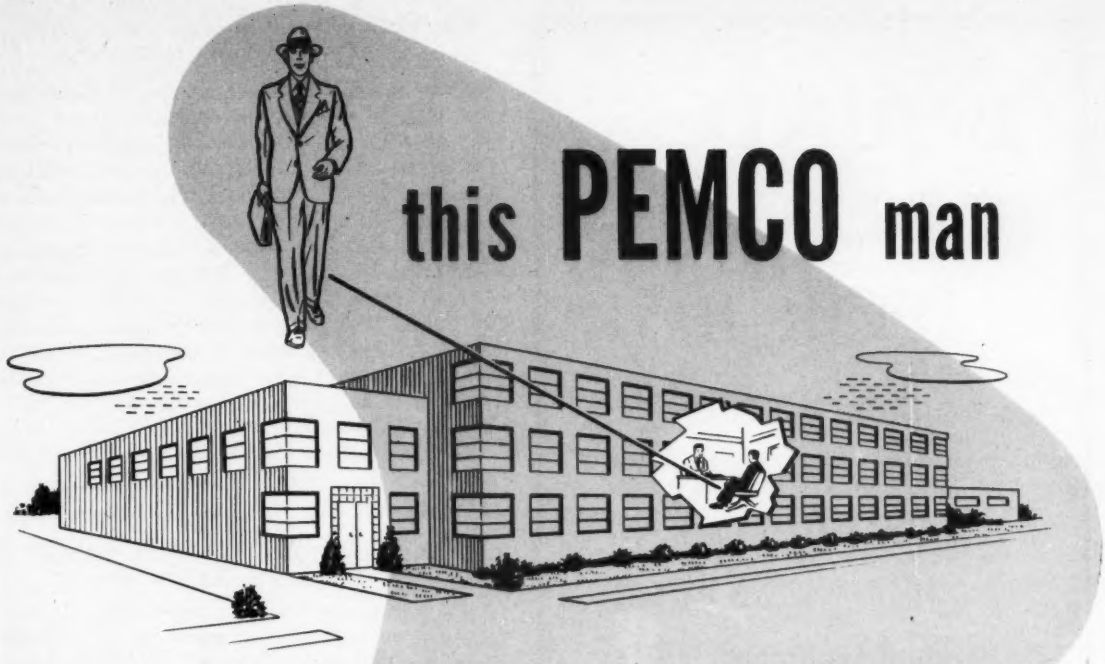
POTASSIUM CARBONATE
Dustless Calcined Potassium Carbonate 99-100% K_2CO_3
Granular Hydrated Potassium Carbonate 83-85% K_2CO_3



this PEMCO man

IS ON YOUR STAFF . . . but NOT on YOUR PAY-ROLL!

The Pemco field representative in your area is, for all practical purposes, an important member of your own technical staff. Yet his services are available to you *without cost or obligation.* He is the vital link between your own glass technologists and Pemco Corporation's tremendous research facilities, its laboratory technicians and engineers. Next to the quality of its materials, Pemco prides itself on this continuing service it is performing for the industry. If you have a technical problem, call upon your Pemco field representative to help you in its solution.

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GLAZE FRITS • PORCELAIN ENAMEL COLORS
GLAZE STAINS • GLASS COLORS AND RELATED
CERAMIC MATERIALS

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• By placing your order now, a bound volume of THE GLASS INDUSTRY for 1951 will be reserved for you. The supply is limited. Therefore, copies must be reserved as orders are received. All twelve issues are attractively bound and, with the annual index, serve as an indispensable reference medium to all technical and production problems of glass manufacture.

Price $8.25

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The Glass Industry

55 WEST 42nd STREET

NEW YORK 18, N. Y.

JOB SETUPS . . . .

(*Continued from page* 408)

loss. This loss can be kept to a minimum by careful planning.

The time, "M," for mechanical changes is represented as 100% loss. Even though this is the period of greatest rate of loss, it is usually possible to keep the total loss relatively small.

The greatest potential loss from a job change is during the workout time, "W." This part of the job change requires the greatest skill, and presents the most problems. It is during this time that all the fine adjustments of the equipment must be made. Unless adequate help and skill are made available the workout time will be excessive and the number of hours to complete job "B" will be greater than normal. The maintenance of detailed records and emphasis on job training and procedure offer the best solution to the problem of keeping workout to a minimum.

MINNEAPOLIS-HONEYWELL NAMES NEW REGIONAL SALES HEADS

John A. Robinson has been named Sales Manager of the Eastern and Mid-Atlantic regions for the Industrial Division of Minneapolis-Honeywell Regulator Company, it has been announced by W. H. Steinkamp, General Sales Manager.

At the same time, it was announced that Joseph J. Matulis has been named Industrial Manager for the Midwest region to succeed Mr. Robinson, and that C. G. Behnke has been named Industrial Manager of the Chicago branch office.

AMCO

Design, Erection and Operation of Manufacturing Plants and Furnaces for All Types of GLASS WARE

AMSLER MORTON CORPORATION

CHAMBER OF COMMERCE BUILDING, PITTSBURGH 19, PA.

AMERICAN POTASH & CHEMICAL TO BUILD LABORATORY

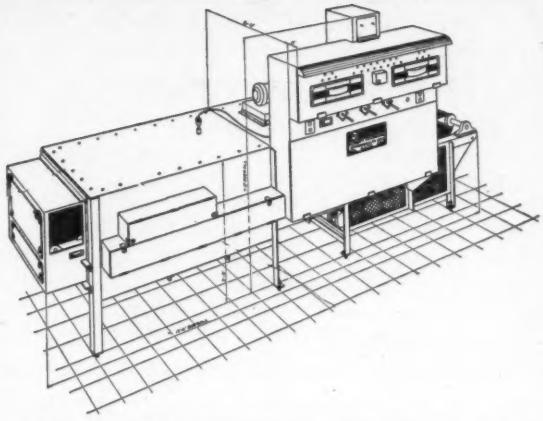
American Potash & Chemical Corporation has announced that it will start construction of a research laboratory in the Los Angeles area. The new facility, to cost approximately $300,000, will be located at Whittier, California. It will be designed and built by the Austin Company and will be completed early in 1953.

The company's research program is under the general supervision of D. S. Dinsmoor, Vice President—Research and Development, aided by T. F. Edson, Assistant Vice President—Research and Development. The new laboratory, as well as the Trona facility, will be under the direct supervision of W. A. Gale, Director of Research.

INNIS, SPEIDEN HOLDS SALES MEETING

Innis, Speiden and Company held a three-day sales symposium recently at which all manager and sales personnel from New York, Boston, Gloversville, Philadelphia, Cleveland, Cincinnati and Chicago were present. J. A. Schade, Laboratory Supervisor and Technical Consultant at the Jersey City plant, also sat in on many of the discussions.

D. S. Cushman, Vice President, presided over the meetings, whose purpose was to bring the sales organization up to date on new products and future plans of the company. In addition, each Sales Department Manager discussed with the group his respective products, their uses and potentials.



● Above illustration shows a special electric oven for the annealing of light ware as required for the electronic field.

Our knowledge of glass factory problems is your assurance of first quality glass melting and manufacturing equipment, as well as top service and performance.

We shall be pleased to consult with you concerning your manufacturing problems.

HENRY F. TEICHMANN, INC.

INVESTMENT BUILDING — PITTSBURGH 22, PA.
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Qualitative Observation
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Quantitative Measurement
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At every step, from mine to shipment, Gold Bond glasshouse lime and limestone products undergo intensive quality control. Only National Gypsum can supply *all* of these products—Gold Bond High Calcium Limestone, Gold Bond Dolomitic Limestone, Gold Bond Dolomitic Fluxing Lime, Gold Bond Dolomitic Hydrate and Gold Bond Low-Iron Calcium Carbonate.

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A glass spade, made for the occasion, was used in the ground-breaking ceremony held at Vineland, New Jersey, where Kimble Glass Company, an Owens-Illinois subsidiary, is building what is said to be the nation's most modern tube manufacturing plant. W. G. Swanson, left, Plant Manager, hands the spade to Michael J. Rafter, center, Kimble employee for 49 years, as Vineland's Mayor, John Gittone, right, and other civic and company officials look on.

J. D. BIGGERS, L-O-F PRESIDENT, REPORTS TO STOCKHOLDERS

Glass sales in the first five months of 1952 have been showing a steady upward climb from the final months of last year, but have not reached the all-time record set in the forepart of 1951, according to John D. Biggers, President of Libbey-Owens-Ford Glass Company, in a brief report to share owners recently.

Mr. Biggers said that unless developments in the steel industry have an adverse effect, "there are indications that the lifting of credit restrictions and the availability of more liberal supplies of materials will increase building construction and automotive production during coming months, and may provide a stimulus to general business."

The L-O-F president outlined briefly the new two-year labor agreement negotiated with the Federation of Glass, Ceramic & Silica Sand Workers of America, CIO, now pending for approval by the Wage Stabilization Board.

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WYANDOTTE ANNOUNCES FELLOWSHIP

Wyandotte Chemicals Corporation has announced that a pre-doctoral study fellowship in organic chemistry has been established at Wayne University. Vince Traynellis, South Hackensack, New Jersey, a graduate of Rutgers University, is the first to receive the award of $1200, plus tuition and fees granted by the fellowship.

Mr. Traynellis will work under the direction of Calvin Stevens, associate professor of organic chemistry at Wayne, on the structure of compounds formed from phenacyl bromide-base reactions and also on gem dihalides produced by the Hofmann Reaction.

OWENS-CORNING SUBSIDIARY PURCHASES INTEREST IN MARINE ENGINEERING FIRM

Purchase of a controlling interest in the Marine Engineering and Supply Company by a subsidiary of Owens-Corning Fiberglas Corporation has been announced by L. R. Kessler, Vice President and General Manager of Owens-Corning's Pacific Coast Division.

Marine Engineering and Supply Company is a 25-year old firm that distributes and contracts to install insulation products. The firm will be established as the Marine Engineering Division of the Fiberglas Engineering and Supply Company.

GLASS FIBERS APPOINTMENT

Thomas R. Simkins has been named branch manager at Detroit and will direct transportation sales for Glass Fibers, Inc., according to R. W. Capaul, Vice President and General Sales Manager of the company.

Mr. Simkins was formerly Vice President and a director of the Glasfloss Corporation. He holds several patents on the use of glass fibers in the air filtering and automotive battery fields. He has formerly been associated with Owens-Corning Fiberglas Corporation and served as Manager of their Research Laboratory at Newark, Ohio, from 1939 to 1943.

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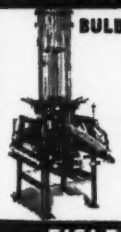

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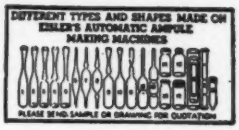

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